

## Classification of towns in 1891 using factor analysis

**Harry Smith, Robert J. Bennett and Dragana Radicic**

hjs57@cam.ac.uk

rjb7@cam.ac.uk

DRadicic@lincoln.ac.uk

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University of Cambridge, Department of Geography and Cambridge Group for the History of Population and Social Structure, Downing Place, Cambridge, CB2 3EN, UK.

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Comments are welcomed on this paper: please contact the authors by email as above.

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## Classification of towns in 1891 using factor analysis

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### 1. Introduction.

This paper discusses how factor analysis can be used to classify the towns and urban areas in England and Wales of over 10,000 population using the occupational structure of their populations derived from census data for 1851-1911. This first analysis is based on 1891 as a pilot for the other census years. It pilots a classification of all occupied populations, and also employers, own account, and all entrepreneurs. The paper uses the database for Entrepreneurs 1851-1911 referred to in this and other project Working Papers developed by ESRC project ES/M010953 *Drivers of Entrepreneurship and Small Businesses*. For this paper the I-CeM source for 1891 is used in version 2, updated with other data cleaning.<sup>1</sup>

The population census returns for individuals/householders in the 1891 census are derived from the original Census Enumerators Books (CEBs). Individuals followed a census instruction to give their main occupation. This information provides the basis of the assessments in this paper which seek to identify a classification of groups of occupations in different towns. It is recognised that the population census was not perfect in the design of questions about occupations, or in the classification and processing of the householder's returns. This constrains the data and the interpretations possible. A fuller discussion of the nature of the data, and their limitations, is given in the ESRC project WP 2: *Employers and*

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<sup>1</sup> K. Schürer, E. Higgs, A.M. Reid, E.M Garrett, *Integrated Census Microdata, 1851-1911, version V. 2 (I-CeM.2)*, (2016) [data collection]. UK Data Service, SN: 7481, <http://dx.doi.org/10.5255/UKDA-SN-7481-1>; enhanced; E. Higgs, C. Jones, K. Schürer and A. Wilkinson, *Integrated Census Microdata (I-CeM) Guide*, 2<sup>nd</sup> edn. (Colchester: Department of History, University of Essex, 2015).

*the self-employed in the censuses 1851-1911: The census as a source for identifying entrepreneurs, business numbers and size distribution.*

This paper first discusses the methodology (Section 2). Section 3 applies the method to classification of the entire economically active population of towns (all workers, employers and own account). Section 4 applies the method to employers only, section 5 to own account only, and section 6 to all entrepreneurs (employers plus own account). In each section the factor loadings are given and a mapping for the original and final classification after ‘direction’. The same analysis is undertaken solely for females in the cases of all occupied, and all entrepreneurs, which are the two situations where the number of females is sufficient. The paper forms a stepping stone towards the classification of entrepreneurs for each of the censuses using a similar methodology.

## **2. Methodology.**

### **2.1. Factor analysis**

Factor analysis uses the correlation coefficients between pair-wise variables to reduce a large set of explanatory variables (occupations in this case) to a more limited number of groups (factors) based on their shared variance. Common features are identified by use of the correlation matrix. This paper combines aspects of the two most common factor analysis techniques, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA): beginning with EFA but applying aspects of a ‘directed’ structure for interpretation that requires confirmation against known patterns derived from the secondary literature. We use the PCA (principal component analysis) approach (Osborne and Costello, 2005) which is generally favoured when the number of variables per factor is large (Goldberg and Velicer, 2006), and in large datasets (Osborne and Costello, 2005), both of which apply here.

An important decision in EFA is determining the optimal number of factors (Goldberg and Velicer, 2006; Osborne and Costello, 2005), where factors represent substantially independent (uncorrelated) patterns of relationships between variables (Rummel, 1967, 1970). The most commonly method is to retain those factors that have eigenvalues greater than one, although this is among the least accurate methods (Osborne and Costello, 2005).

We opt to allow the analysis to run to the automated cut-off in the software (which is for eigenvalues of one and greater), but then investigate the value of each factor in a ‘directed’ study. After the first stage of PCA we apply the commonly used method of “orthogonal” factor rotation to achieve an outcome where each factor has a correlation of exactly zero with all the other factors. In addition, we applied the “varimax” algorithm (Kaiser, 1958), which is the most commonly used procedure for “orthogonal” factor rotation (Goldberg and Velicer, 2006; Osborne and Costello, 2005). The resulting factor loadings determine how much the variable has contributed to the corresponding factor, whereby a larger factor loading implies that the variable’s contribution is larger and vice versa (Rummel, 1967, 1970; Yong and Pearce, 2013). All calculations were undertaken in Stata.

After the first stage of factor analysis many towns have high scores on several factors. This means that whilst the different factors are orthogonal to each other, it is quite possible for a given town to have attributes that relate strongly to quite different factors; for example it may be quite agricultural, but also have aspects that are port-related; or it may be a commercial centre, but also have a specific industrial concentration such as heavy manufactures (as in the W. Midlands), or shoe manufactures (for Kendal or Northampton), or textiles (for example, Manchester). To obtain a more general classification it is necessary to assess how far any town is primarily loaded on one factor rather than others. In the following analyses this is undertaken through a two-stage process: first the ‘original’ classification and mapping is shown taking a purely automatic scoring of towns to their highest factor; second, this score is then tested through a series of tests, or ‘directions’, and adjusted to produce a ‘final’ classification. For the final mapping, a number of potential confusions or ambiguities that make the original classification problematic are removed. This ‘directed’ approach involves scrutinising each town’s score for each factor. This combines aspects of the standard approaches of ‘exploratory’ and ‘confirmatory’ factor analysis; where the exploratory approach has been used to inspect the first factor allocations, and the confirmatory approach is used to ensure interpretation meets criteria of interpretability against known patterns: a ‘reality check’. The starting point of the automatic ‘original’ classification is thus tensioned against alternatives taking account of sample size in each town, and against the known patterns of different locations derived from secondary literature.

The judgement on the groupings of towns for each factor was made by reference to the factor scores in 6 stages:

ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.

1. Each town was classified to the factor on which it had the highest score. This gave a first classification of each town which were then scrutinised:
2. Those where the highest score on any factor was below 0.5 were re-allocated to a separate group with ‘no strong loadings’.
3. Those towns which had scores over 0.5 were scrutinised to check that none had a strong alternative classification to different factor(s) for which their scores were close to that on the highest factor to which they had been classified. These were candidates for possible re-allocation.
4. A control was made for small sample sizes. The towns were ranked on the number of census entries for all the occupations on the relevant factor. These were then scrutinised individually to remove those with very small census numbers but with high loadings that distorted the allocation. Where towns with very small numbers on the identified factor had an alternative high factor loading that would allocate them to a different factor for which they had a substantial number of census respondents, they were re-allocated to that factor. This was undertaken for all towns below a given respondent size for that factor (defined below).
5. If in step 4 there was no alternative factors with high loadings, those with small census numbers were allocated to the separate group with ‘no strong loadings’.
6. A final check was made of all those towns with small census numbers (but above the specified respondent size) to check for matches against known spatial patterns. This resulted in a few being reallocated to high-ranking alternative factors.

These tests are mainly a negative test: to make reassignments where there was a strong indication of a mis-coding. The detailed decisions in each case are outlined below.

The towns that did not score highly on any of the factors are allocated to a separate group, termed ‘no strong loadings’. These are towns which have no high concentrations on any of the employer variables: they are close to the general average occupation distribution across the country, or have no spatial concentrations high enough on any occupation to give them a high factor loading.

The approach followed has to be carefully tailored to each analysis: all occupied, all entrepreneurs, or employers or own account only.

## ***2.2. Spatial level and Census data used***

The purpose of the analysis is to classify towns to common entrepreneurial characteristics. The spatial basis chosen is census Registration Sub-Districts (SRDs) in England and Wales. There were 2110 of these in 1891. In addition use is made of parishes where towns cut across different RSD boundaries. The definition of the town units used is discussed at length in another working paper: WP 6: *Urban-Rural Classification, 1851-1911*. This uses GIS comparisons to match published parish populations totals combined with I-CeM Registration Sub-District (RSD) and parish data to the Law-Robson calculations of population size for the towns/cities they identify for each census year 1851-1911. This method identifies each town with a population over 10,000 in each census year. There were 307 of these towns in 1891.

Town units are generally quite large and have the advantage of aggregating small units which smooths potential errors and noise in the data. Towns also usually bring residential locations together with workplaces for most of the population, which for employers can otherwise be separated and quite dispersed. Some employers and workers will still be located a long way from their residence, but for most small businesses and their workers the location of business and residence will be in the same town.

The Census data extracted had careful pre-screening and cleaning to ensure that the subsequent analysis used consistent definitions and was not distorted by spurious entries, or occupationally inactive population. Hence, although many younger people were engaged in occupations, this was often inconsistently recorded by enumerators and may not properly separate full and part-time activity. To ensure consistency, the data used excluded everyone under 15. Also excluded was anyone who was retired, listed only as ‘pensioner’ or ‘former’, living on own means, unemployed, and students, scholars, or pupils.

Because the aim is a classification of the entrepreneurial character of towns it was important to focus on those that were permanent or longer-term residents. As a result boarders, visitors and lodgers were excluded, as were those in institutions or ships. Whilst some boarders and institutional inmates will have been long-term residents of that locality, these categories

include many for whom the relationship to the locality was unclear. For employers, in particular, it rarely identifies people who are long-term residents: most are in hotels as part of a business buying or selling activity, or are visitors to another household on census night. Given the small numbers of employers in total, the inclusion of boarders, lodgers and visitors would have a potentially severe distortion effect on spatial classification.

Because the focus of this analysis is on entrepreneurs anyone who gave no answer to the employment status question as to whether they were employer, own account, or worker was also excluded. This means that the population covered in this paper is only those who explicitly acknowledged their status as workers, employers, or own account. Similarly excluded were all with nil or illegible answers to the employment status and occupation questions.

For employers and own account there were additional exclusions to ensure consistency of these categories. For the analysis of those who were fully occupied and definitely of employer or own account status, there were sometimes confused responses which had to be screened; e.g. someone might respond as ‘apprentice master’ with an employer or own account status; or ‘assistant to’. All individuals with references to the following in their occupational descriptors were excluded from employer and own account: apprentice, journeyman, servant, clerk, assistant and attendant. Similarly, those with generic descriptors that were insufficient to be confident of their status were excluded, even where they had stated that they were employers or own account: labourer, mechanic, artisan and machinist. In addition employers and own account with I-CeM occupational codes that were considered to be implausible as business proprietors were excluded. For this analysis we erred on the side of caution; some of these codes are used in later analyses (such as 45-47 the nursing codes). There were 119 of these categories, ranging from ‘farmer's and grazier's son, daughter, or other relative assisting in the work of the farm’ to ‘railway guard’, ‘church chapel cemetery caretakers and keepers’, ‘technicians (unspecified)’, ‘bricklayer's labourer’, and ‘foreign diplomats’. Also excluded were those that were employees of government or quasi-state industries: e.g. municipal, parish, and other local or county officers; civil service officers and clerks; post office officers and clerks; prison officers; police; all military; hospital workers; and ministers, priests, or in other religious bodies. As stated, all these categories were included in analysis of the full economically active, but not in the employer or own account

categories (unless exceptional from their descriptors). A full listing is given in Working Paper 5 on occupational status.

### ***2.3. Aggregation of occupations into 50 occupational groups***

The occupational categories used are based on aggregations to 50 occupational groups. These groups are described in detail in Working Paper 5. Aggregation is essential for the factor analysis to converge. The original I-CeM coding offers a range of occupation classifications, including one based on the 1881 Census Report with 399 categories and an I-CeM-specific classification with 797 occupational categories. Both of these levels contain many occupations with very small numbers of people. When disaggregated around the 2110 RSDs this results in many RSDs having zero entries or very small numbers than can distort statistical analysis, especially for employers and women. Aggregating to 50 occupational categories overcomes most of these difficulties, though it is accepted that this approach imposes an order and grouping on the occupations from the outset.

## **3. Classification of towns for all occupied**

### ***3.1 All occupied males and females***

The classification developed focuses on the 307 towns and cities of 10,000 population and greater in 1891. Because the number of locations is relatively small, and they have been pre-classified to be urban areas, it is expected that the variation between places will be much more limited than in the RSD classification developed in other working papers (q.v.). The results for the whole occupied population shows that the variance (Table 1) is heavily concentrated in Factor 1, then Factors 2 and 3, but with some significance down to Factor 16.

The factor loadings in Table 2 and subsequent factor loading tables are highlighted where there are potentially significant loadings above a value of 0.2 (marked in yellow), and where they are the highest loading for all factors for that occupation they are marked brown. Negative loadings are highlighted in blue where their value is smaller than -0.5.



Factor	Variance	Difference	Proportion	Cumulative
Factor 1	10.21907	7.39972	0.2044	0.2044
Factor 2	2.81935	0.11395	0.0564	0.2608
Factor 3	2.70540	0.53457	0.0541	0.3149
Factor 4	2.17084	0.43190	0.0434	0.3583
Factor 5	1.73894	0.02122	0.0348	0.3931
Factor 6	1.71771	0.03390	0.0344	0.4274
Factor 7	1.68382	0.09289	0.0337	0.4611
Factor 8	1.59092	0.00974	0.0318	0.4929
Factor 9	1.58118	0.05674	0.0316	0.5245
Factor 10	1.52444	0.00237	0.0305	0.5550
Factor 11	1.52207	0.01139	0.0304	0.5855
Factor 12	1.51068	0.15982	0.0302	0.6157
Factor 13	1.35086	0.03517	0.0270	0.6427
Factor 14	1.31568	0.01786	0.0263	0.6690
Factor 15	1.29782	0.01485	0.0260	0.6950
Factor 16	1.28297	-	0.0257	0.7206

**Table 1.** Factor variance – All economically occupied

Number of obs = 307

Method: principal-component factors      Retained factors = 16

Rotation: orthogonal varimax (Kaiser off)      Number of params = 680

LR test: independent vs. saturated:  $\chi^2(1225) = 1.0e+04$  Prob> $\chi^2 = 0.0000$

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16
1	farming, fishing, market gardeners, horse breeding and keeping	0.738	-0.2158	0.104	-0.0464	-0.0208	0.0029	0.0267	0.2204	-0.0676	-0.0811	-0.0711	-0.1134	-0.1414	-0.0586	0.0544	0.0604
2	coal mining	-0.3989	-0.1042	-0.2413	-0.1502	-0.2413	-0.2791	-0.0042	-0.1413	-0.1305	-0.028	-0.5792	-0.1728	0.0971	-0.1709	-0.0418	0.0796
3	other mining & quarrying, brickmaking, gravel, salt works	-0.1011	-0.0424	-0.1086	-0.0756	-0.0408	0.0144	-0.1074	0.0313	-0.0506	-0.0304	-0.0081	0.0502	-0.1087	-0.7685	-0.0929	-0.0602
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.7091	0.1768	0.0772	0.0515	-0.0387	0.0238	0.041	-0.042	0.0358	-0.0374	0.1505	-0.081	-0.0163	0.0683	0.1122	0.1042
5	machinery mf	-0.1417	0.8647	0.0175	0.1266	0.0028	0.055	0.0016	0.0762	0.0077	-0.0515	0.03	0.0586	-0.094	0.1538	0.0089	0.0182
6	tool & weapons mf	-0.0669	0.0435	0.0754	-0.0419	0.8898	-0.0446	0.0245	-0.0649	-0.0042	0.0563	0.0193	0.0239	0.0274	-0.0271	0.019	-0.0298
7	iron & steel mf, bolts and nails	-0.2865	0.4962	-0.0476	-0.2018	0.0586	-0.2417	0.0377	-0.2454	-0.096	0.0082	0.2931	-0.0913	0.1582	-0.1989	-0.0609	-0.1037
8	blacksmiths	-0.1255	0.8056	-0.1253	0.1192	0.0075	-0.2242	-0.0464	0.043	-0.0115	0.0465	-0.0149	-0.1011	0.0626	-0.1698	0.0178	0.0416
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	-0.1179	0.1744	0.0558	-0.024	0.0196	-0.0053	-0.031	-0.3189	0.1642	-0.0295	0.189	-0.0011	0.0289	-0.149	0.0575	0.5704
10	ship, road & rail vehicle mf	0.049	0.3814	-0.0416	0.6658	0.0931	-0.0891	-0.0812	0.097	0.0435	0.0788	0.0933	0.019	-0.0574	0.052	-0.0689	0.043
11	earthenware & glass mf	-0.1445	-0.0025	0.0112	-0.055	-0.0686	-0.0892	0.0463	0.0318	-0.0342	0.806	-0.0372	-0.0676	-0.0045	0.0087	0.0627	-0.0338
12	gas, coke and chemical mf	-0.0827	0.0088	-0.0765	0.0166	-0.0109	-0.0496	-0.0306	-0.0236	0.0232	0.0028	-0.0067	0.088	-0.0209	0.0518	0.8506	-0.0536
13	leather, fur, hair & bone mf	0.0305	-0.0157	0.1154	-0.0813	0.1416	0.1061	0.0361	0.1793	0.0878	0.0119	0.2045	0.6411	0.128	-0.0438	0.2332	0.0721
14	wood mf (sawyers, coopers, cane workers)	0.0449	0.0359	0.037	0.0899	0.0095	-0.0464	0.6657	0.1696	0.5576	0.0729	0.0702	0.0462	-0.0837	0.0474	0.176	0.0062
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.1792	-0.0368	-0.0125	-0.0199	-0.0025	0.0021	0.0743	-0.0166	0.8779	-0.0014	0.0017	-0.0111	-0.019	-0.0008	-0.0179	-0.0071
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.1455	0.0203	0.1636	-0.0993	0.1233	0.0604	-0.1049	0.3605	0.5014	-0.0724	0.093	0.0485	0.2897	0.1739	-0.0425	-0.0924
17	waterproof goods mf (floor & oil cloth, rubber etc.)	-0.0394	-0.0019	-0.0088	-0.0559	0.0621	-0.0097	-0.0637	0.2021	-0.1084	0.0075	-0.0528	0.0329	-0.075	0.1459	-0.1029	0.7211
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.1641	-0.0368	-0.0015	-0.078	-0.0188	0.8561	0.0108	-0.0418	-0.0194	-0.0118	-0.0248	0.0265	0.1258	-0.0784	0.0046	0.0341
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.4582	-0.3386	0.0111	-0.122	-0.0771	0.0376	-0.2466	0.1614	-0.0126	-0.1886	0.2288	-0.0845	-0.2597	0.3332	-0.1574	-0.2976
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	-0.2628	-0.1763	0.0216	-0.0715	-0.033	0.6758	-0.0486	0.1227	0.024	-0.1232	0.1512	-0.0276	0.0314	0.1127	-0.1423	-0.0953
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	-0.122	-0.1446	-0.0907	-0.0767	-0.0775	-0.0952	0.0607	-0.0973	-0.0252	-0.0591	0.082	0.2814	0.0474	0.3306	-0.1937	0.2169
22	shoe, boot, clog mf	0.036	-0.0348	0.02	-0.0225	-0.0463	-0.0265	0.038	-0.0611	-0.0407	-0.0452	-0.0686	0.7807	-0.0441	-0.0109	-0.0067	-0.0193
23	agric produce mf (millers, refiners, bakers, confectioners)	0.1855	0.1185	0.0432	0.0193	-0.0396	0.0511	0.2104	0.7095	0.0886	-0.0001	0.1066	0.0283	0.1362	-0.0481	0.0094	0.0709
24	drink & tobacco mf (malsters, brewers, distillers, tobacco & pipes)	0.1346	-0.0302	0.0135	-0.0257	0.0187	0.016	0.8819	0.0397	-0.0186	-0.0439	0.0198	0.0235	-0.0097	0.0458	-0.0871	-0.0411
25	watch & instrument mf	0.075	-0.0261	0.0083	0.0307	0.8944	0.0138	-0.0007	0.0515	0.0247	-0.0323	0.0459	-0.0024	-0.0393	0.0491	-0.0334	0.0656
26	general mf (manufacturers, mechanic, artisan, machinist)	-0.4385	0.3758	-0.0119	0.1783	-0.0833	0.0409	0.0216	-0.3092	-0.1365	-0.1378	-0.0478	-0.2548	0.1108	-0.3008	0.1403	0.2082
27	ocean, inland and dock transport	0.2026	0.0377	0.0933	0.768	-0.075	-0.0949	0.1016	-0.0149	-0.0499	-0.0116	0.1834	-0.1318	0.0643	-0.0293	0.2222	-0.0008
28	road & rail transport	0.6099	-0.1387	0.3497	-0.0102	-0.0914	-0.0141	-0.0758	-0.2512	-0.0162	0.0189	0.0958	-0.2445	0.0037	0.1299	0.0223	-0.1153
29	coal dealing	0.2551	0.013	0.1357	0.0592	0.0734	-0.0268	0.0704	0.0333	0.0038	-0.0262	0.7905	-0.0195	-0.0336	-0.0283	-0.0049	0.0584
30	timber, hay, corn and agric produce dealing	0.5557	0.0721	0.1111	0.0973	-0.0344	-0.1564	0.251	0.3674	0.1738	-0.036	0.0965	-0.0241	0.0858	-0.1081	-0.0438	0.1348
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.7407	0.0102	-0.043	0.1475	-0.0018	-0.0264	0.1038	0.0745	0.1423	0.016	0.0619	0.2282	0.0923	-0.1291	-0.1591	0.0409
32	food sales (butchers, fishmongers, cheesemongers, milkshellers, grocers)	0.8526	-0.0553	0.0573	0.1194	0.0039	-0.0717	0.108	0.1585	0.029	0.0118	0.1432	0.0043	0.071	0.0262	0.0077	-0.0602
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.684	-0.0734	-0.1527	0.0155	-0.0097	-0.0852	-0.013	-0.1872	-0.0341	0.1273	0.1402	-0.0713	0.0766	0.1273	-0.0077	-0.098
34	stationery dealing (stationers, publishers, newsagents)	0.8165	-0.0452	0.245	-0.0246	0.0065	-0.0169	-0.0666	0.0347	0.1178	-0.0415	0.0615	0.0788	0.079	0.1174	-0.0801	-0.089
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.0864	-0.0313	0.0574	0.0431	0.0947	0.0041	-0.0612	-0.0352	0.0367	0.8149	0.0209	0.0309	-0.0224	0.0076	-0.0724	0.0253
36	ironmongers	0.7408	0.0276	0.0201	0.0443	-0.0215	-0.1121	0.0444	0.1617	0.1648	0.0134	0.1914	0.072	0.1249	-0.1429	-0.0737	0.0547
37	other retail (general shopkeeper, huckster, hawker)	0	-0.0517	0.0202	-0.0026	-0.0002	0.2892	-0.0339	0.1055	0.0496	0.0242	-0.071	-0.0597	0.7379	0.0451	0.0278	-0.0491
38	chemists, druggists	0.6926	0.0479	-0.0793	0.0106	0.0329	-0.0237	0.1568	0.204	0.0534	-0.0056	0.1704	0.1008	0.053	0.0763	0.0596	0.0267
39	merchants, banks, insurers and brokers	0.076	-0.1091	0.8664	-0.0675	0.0935	0.1171	-0.105	-0.0002	-0.0159	0.0801	0.1071	-0.0142	-0.0569	0.0505	-0.0625	-0.0579
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.4024	-0.0348	0.7749	-0.0109	-0.032	-0.0447	0.012	0.004	0.0686	-0.0073	0.0393	0.0979	0.0613	-0.017	-0.0768	0.0671
41	construction management (builders and contractors)	0.5089	0.4995	0.1829	-0.0934	0.0127	0.2828	0.0991	-0.0562	0.0233	-0.0626	-0.0307	0.069	-0.1608	0.2018	0.0275	0.0273
42	professions (barristers, solicitors, scientific pursuits)	0.6214	0.3014	0.4428	-0.0012	-0.0404	-0.049	-0.0725	0.0522	-0.005	-0.0897	-0.0964	0.0023	-0.0892	-0.0786	-0.0106	-0.0642
43	professions (doctors, dentists, artists, performers, education)	0.9303	-0.0489	0.1674	0.0549	0.0012	-0.0596	0.0627	-0.0478	0.0274	0.0556	0.0196	0.0011	0.0396	0.0088	-0.0057	-0.0175
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.8908	-0.146	0.0708	0.0525	0.0483	-0.0171	0.0055	-0.0078	0.0568	-0.0206	0.0304	0.0316	-0.0182	0.0565	-0.0439	-0.0404
45	Public admin, clergy	0.7429	0.049	0.2632	0.3912	0.022	-0.0216	0.0618	0.1055	0.0191	-0.0572	-0.0843	0.0237	-0.058	0.0029	-0.005	-0.0016
46	Military	0.2332	0.0474	-0.096	0.7986	-0.0038	-0.0067	-0.0175	-0.0393	-0.0021	-0.038	-0.0911	0.0301	0.0264	0.0411	-0.1018	-0.0618
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.4007	0.0954	0.7355	0.1039	0.0571	-0.0885	0.2847	0.0767	-0.0028	-0.0086	0.0862	0.0114	0.0612	0.0737	0.0994	0.0683
48	Domestic and service staff, cooks	0.7408	-0.1151	0.1689	0.1656	0.0292	-0.1158	-0.0323	-0.1169	-0.0434	-0.0894	-0.0635	-0.1347	-0.0311	0.005	0.1667	0.0901
49	Labourers & transport staff (including family on farms)	0.3338	0.3613	0.091	0.1497	-0.0886	-0.0916	0.1931	0.235	-0.0887	-0.1691	0.1284	-0.1559	-0.024	-0.0234	0.3888	0.2888
50	Persons of property and unoccupied	0.2718	-0.0225	-0.0155	0.0964	-0.0536	-0.0873	-0.0532	0.0363	-0.0996	-0.1082	-0.0131	0.1502	0.615	0.0924	-0.1105	0.0063

Table 2. Factor loadings for all occupied

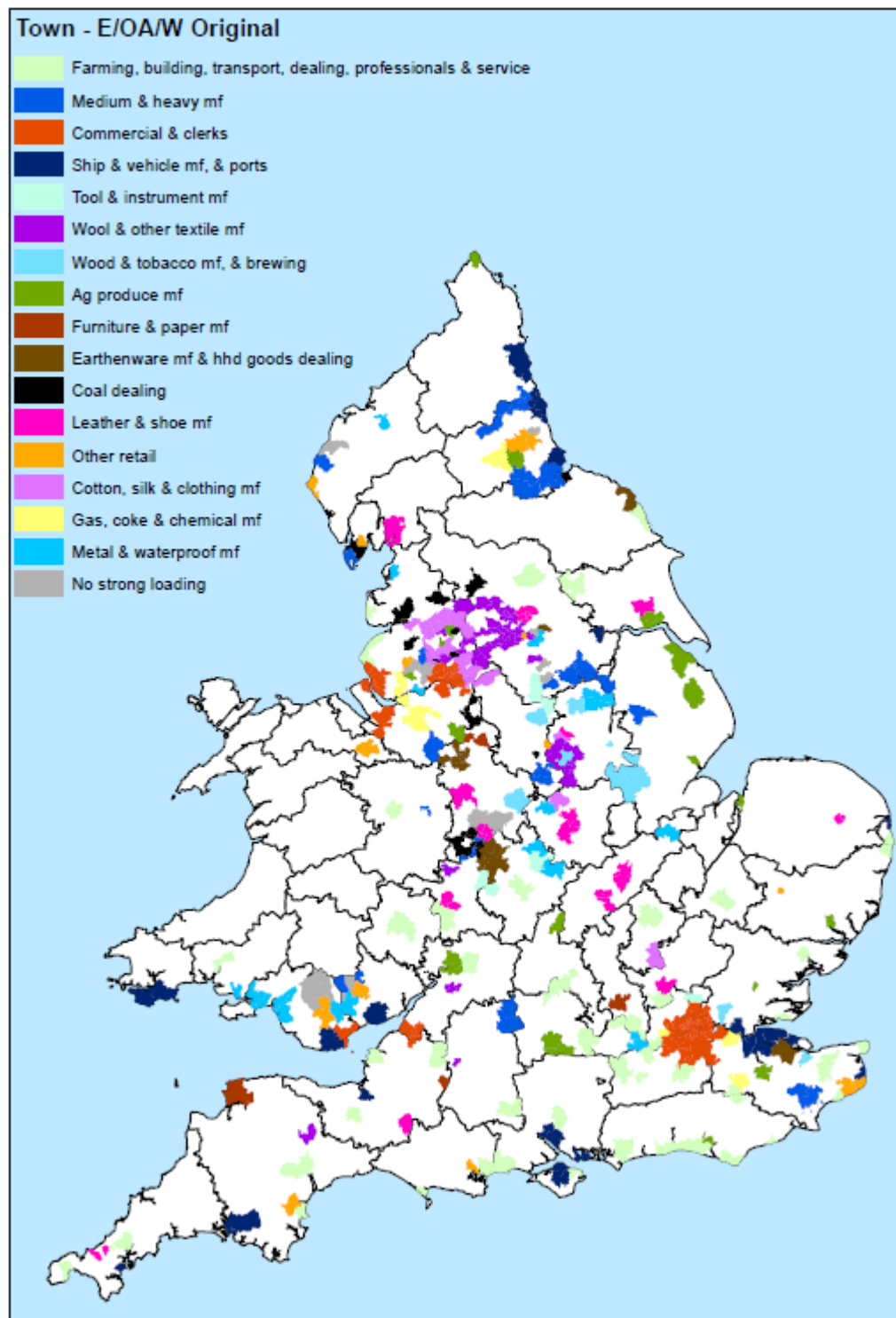
ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.

The loadings for each factor are summarised below. The discussion focuses exclusively on the occupational group loadings on a factor where they are the highest for that occupational group (i.e. highlighted in brown in Table 2). The mapping of the 16 factors (Figure 1) assigns each town to the factor on which it scores most highly. This is the ‘original’ mapping from a raw assignment. In the discussion below the stages are outlined for each factor of how decisions are made to produce a final classification of towns using the ‘directed’ factor analysis methodology. The final mapping which is reduced to 14 factors plus a no strong loading and special coal group (16 in all) is shown at the end of this discussion (Figure 2).

Each factor can be summarised:

**Factor 1 (urban functions and farming).** The first factor absorbs 18 occupational sectors and includes all the main small retail, transport, professional and commercial functions; but it also includes farming. This is the prime urban identifier including most resorts, but with farming also included it represents the identifier for urban centres which also have rural functions for a farming hinterland:

- Farming, fishing, market gardeners, horse breeding and keeping
- Construction operatives (masons, bricklayers, thatcher, plumbers etc.) [also identical loading on factor 2]
- Road & rail transport
- Timber, hay, corn and agric produce dealing
- Clothing and dress dealing (drapers, hosiers, haberdashers)
- Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)
- Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)
- Stationery dealing (stationers, publishers, newsagents)
- Ironmongers
- Chemists, druggists
- Other commerce (accountants, salesmen, travellers, officers of cos.)
- Construction management (builders and contractors)
- Professions (barristers, solicitors, scientific pursuits)
- Professions (doctors, dentists, artists, performers, education)
- Personal services (washing & bathing, hairdressing, chimney sweeps)
- Public admin, clergy
- Domestic and service staff, cooks
- Persons of property and unoccupied [low loading].



**Figure 1.** Mapping of the classification of each town for all occupied: ‘original’ factor analysis classification.

48 towns have loadings of 1.0 and above for Factor 1. The highest loadings are for major resorts: Blackpool, Bournemouth & Poole, Eastbourne, Hastings, Malvern, Margate, Royal Leamington Spa, Weston-super-Mare, Worthing. Also included are most other resorts (Bath, Brighton, Cheltenham, Harrogate, Ramsgate, Southend-on-Sea, Southport, Torquay, Weymouth etc.) and major county towns and service centres such as: Bedford, Cambridge, Canterbury, Chichester, Colchester, Exeter, Guildford, Hereford, Maidenhead, Oxford, Reading, Reigate, Salisbury, Shrewsbury, Taunton, Truro, Warwick, Watford, Winchester, Windsor & Eton, York. This factor is retained in the final analysis.

**Factor 2 (Medium and heavy mf.):**

Machinery mf

Iron & steel mf, bolts and nails

Blacksmiths

General mf (manufacturers, mechanic, artisan, machinist)

[loading 0.4995; almost identical loading on Factor 1 of 0.51]

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

25 towns which are centres of engineering for railways, shipping, machinery and metal goods. All have high loadings: Ashford, Barrow-in-Furness, Blaenavon, Blaydon, Consett, Crewe, Darlington, Derby, Doncaster, Erith, Gainsborough, Horwich, Lincoln, Lye, Middlesbrough, Newcastle & Gateshead, Oakengates, Rotherham, Rowley Regis, Stockton-On-Tees, Swindon, Tredegar, Wallsend, Wednesbury, Workington. This factor is retained in the final analysis.

**Factor 3 (Commercial, clerks)** The major mercantile and commercial centres:

Merchants, banks, insurers and brokers

Other commerce (accountants, salesmen, travellers, officers of cos.)

Clerks, weighers, telegraph, non-theological students and apprentices

17 towns which are major mercantile and commercial centres, including London, Liverpool, Manchester, Cardiff and Bristol, but also some smaller centres around London and Manchester, this reflects commuter structures. All highly loaded: Altrincham, Bexley, Bristol, Cardiff, Chester, Eccles, Kingston upon Thames, Liverpool & Birkenhead, London, Manchester & Salford, Penarth, Sale, Stockport, Sutton, Teddington, Twickenham. This

factor is retained in the final analysis; Pendlebury (the only place loaded under 1.0, at 0.59, is reassigned).

**Factor 4 (Transport and military):**

Ship, road & rail vehicle mf  
 Ocean, inland and dock transport  
 Military

23 towns, of which high loaded are: Barry, Cowes, Deal, Falmouth, Goole, Gravesend, Grays Thurrock, Hartlepool, Hebburn & Jarrow, Medway Towns, Newport, Pembroke, Plymouth, Portsmouth, Sheerness, South Shields, Southampton, Sunderland, Tynemouth. This is also up picking naval presence, and is a good identifier of ports and shipping-related industries more generally. This factor is retained in the final analysis.

**Factor 5 (Tool and watchmaking):**

Tool & weapons mf  
 Watch & instrument mf

Five towns, but only 4 heavily loaded, all with high tools, guns and skilled engineering manufacturers: Coventry, Enfield, Redditch, and Sheffield. The fifth, Eckinton, Mosborough & Renishaw, is later reassigned to no strong loading.

**Factor 6 (Wool and other textiles):**

Woollen mf (woollen goods, carpets, blanket, flannel)  
 Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

29 towns mostly in the W. Riding, also Colne, Kidderminster, Nottingham, Stroud, Tiverton, Trowbridge. Combines wool textiles with carpets (Kidderminster), blanket areas (Bradford) and lace and other textiles (Nottingham, Stroud, Tiverton and Trowbridge). This factor is retained in the final analysis.

**Factor 7 (Wood, brewing and tobacco mf.):**

Wood mf (sawyers, coopers, cane workers)  
 Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

8 towns, all highly loaded, which are mainly centres of brewing rather than wood: Burton-on-Trent, Chesterfield, Faversham, Grantham, Hucknall, Newark, Romford, Worksop. Chesterfield has low loading and no other high loading, and hence is later reassigned to no strong loading.

### **Factor 8 (Agricultural produce mf.):**

Agric produce mf (millers, refiners, bakers, confectioners)

19 towns: Banbury, Berwick, Bishop Auckland, Boston, Chelmsford, Congleton, Gloucester, Grimsby, Ipswich, King's Lynn, Hull, Lewes, Louth, Maidstone, Newbury, Newton-le-Willows, Rawtenstall, Ramsbottom, West Houghton. Many of these towns have high scores on other factors: 10 have a significant second factor, of which 7 also have a high third factor. Of these other factors, four are for factor 11, three each for 1 and 7, and one or two for 2, 4, 9, 12 and 13. These and other multiple categories they are flagged for subsequent alternative codes. Whilst the first 15 towns look logical on this factor, the last two, Ramsbottom and West Houghton, have low loads and are reassigned to no strong loading.

### **Factor 9 (Furniture and paper mf.):**

Furnishing mf (cabinet makers, french polishers, undertakers)

Printing & paper mf (paper, cardboard, printers, bookbinders)

4 furniture towns, especially highly loaded for High Wycombe; then Barnstaple, Frome and Leek. Leek is the lowest loaded (0.87) and is reassigned to no strong loading.

### **Factor 10 (Earthenware, glass and household goods):**

Earthenware & glass mf

H/h & personal goods dealer (earthenware, glass, jewellers)

11 pottery towns, mainly in Staffs, and the jet trade centre of Whitby: Birmingham & Smethwick, Burslem, Castleford, Fenton, Hanley, Longton, Newcastle under Lyme, Sittingbourne, Stoke-On-Trent Tunstall, Whitby. Mostly very clear differentiation for this group, except Birmingham (loading 2.4) which is almost as highly loaded on Factor 3 (2.3 commercial) and to a lesser level on 5 (1.9 tools). This factor is retained in the final analysis.

**Factor 11 (Coal dealing and mining):**

Coal dealing

*Negative on:* coal mining (-0.58)

23 towns of which the highest loaded are: Belper, Bilston, Brierley Hill, Coseley & Sedley, Dalton-in-Furness, Darlaston, Dudley, Eston, Macclesfield, Nelson, Oldbury, Skipton, Stourbridge, Tipton, West Bromwich, Willenhall, Wolverhampton. Many have high loadings on other factors. This factor is difficult to interpret since coal dealing is quite widespread and the negative coal factor is difficult to relate to any secondary literature for this range of localities. Coal mining is also addressed further as a separate issue below. A decision was made to remove this factor and all the towns on it were reallocated to their highest second loadings which are almost all close to the loading on this factor.

**Factor 12 (leather and shoe mf.):**

Leather, fur, hair & bone mf

Shoe, boot, clog mf

16 towns, most highly loaded are: Beverley, Kendal, Kettering, Leeds, Leicester, Northampton, Norwich, Redruth, St Albans, Stafford, Walsall, Wellingborough, Worcester, Yeovil. Contains the main shoe/boot centres, but also some unexpected towns. The two most highly loaded, well ahead of the rest, are Northampton and Wellingborough. Later reassigned as no strong loading are Mansfield (highest 0.6) and Camborne (highest 0.9); also reassigned are Redruth and St. Albans as low 1.35 with other local variations suggesting this is not an appropriate factor. This factor is retained in the final analysis.

**Factor 13 (other retail):**

Other retail (general shopkeeper, huckster, hawker)

13 towns, with Ossett well ahead of the rest, followed by Wrexham. Other highly loaded are: Alfreton, Bury St Edmunds, Dover, Durham, Newton Abbot, Ossett, Pontypridd, Poole, Ulverston, Wigan. This may be picking up some genuine other traders not included elsewhere, but may also relate to different registrar recording practice not to attribute



shopkeepers to specific goods. The difficulties of interpreting this single occupational factor leads to reallocating all towns to their second factors or no strong loading.

**Factor 14 (cotton, silk and clothing mf.):**

Cotton & silk mf (incl. ribbon, weaving, dyeing, bleaching etc.) [low loading

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather) [low loading, and similar on Factors 12 and 16

*Negative on:* other mining & quarrying, brickmaking, gravel, salt works (-0.77)

22 cotton towns, almost all in Lancs., including slightly lower loadings for Bolton and Blackburn that have a higher level of diversification. This factor is retained in the final analysis.

**Factor 15: (Gas, coke and chemical and transport):**

Gas, coke and chemical mf

Labourers & transport staff (including family on farms) [low loading, and similar load on Factors 1,2, and 16]

10 towns that include the major salt centres, and some small ports: Crook, Dartford, Hounslow, Northwich, Runcorn, Spennymoor, St Helens, Tonbridge, Widnes, Winsford. This factor is retained in the final analysis, with Spennymoor reassigned to no strong loading.

**Factor 16: (Metal and waterproof goods mf.):**

Other metal mf (copper, tin, brass, whitesmiths, etc.)

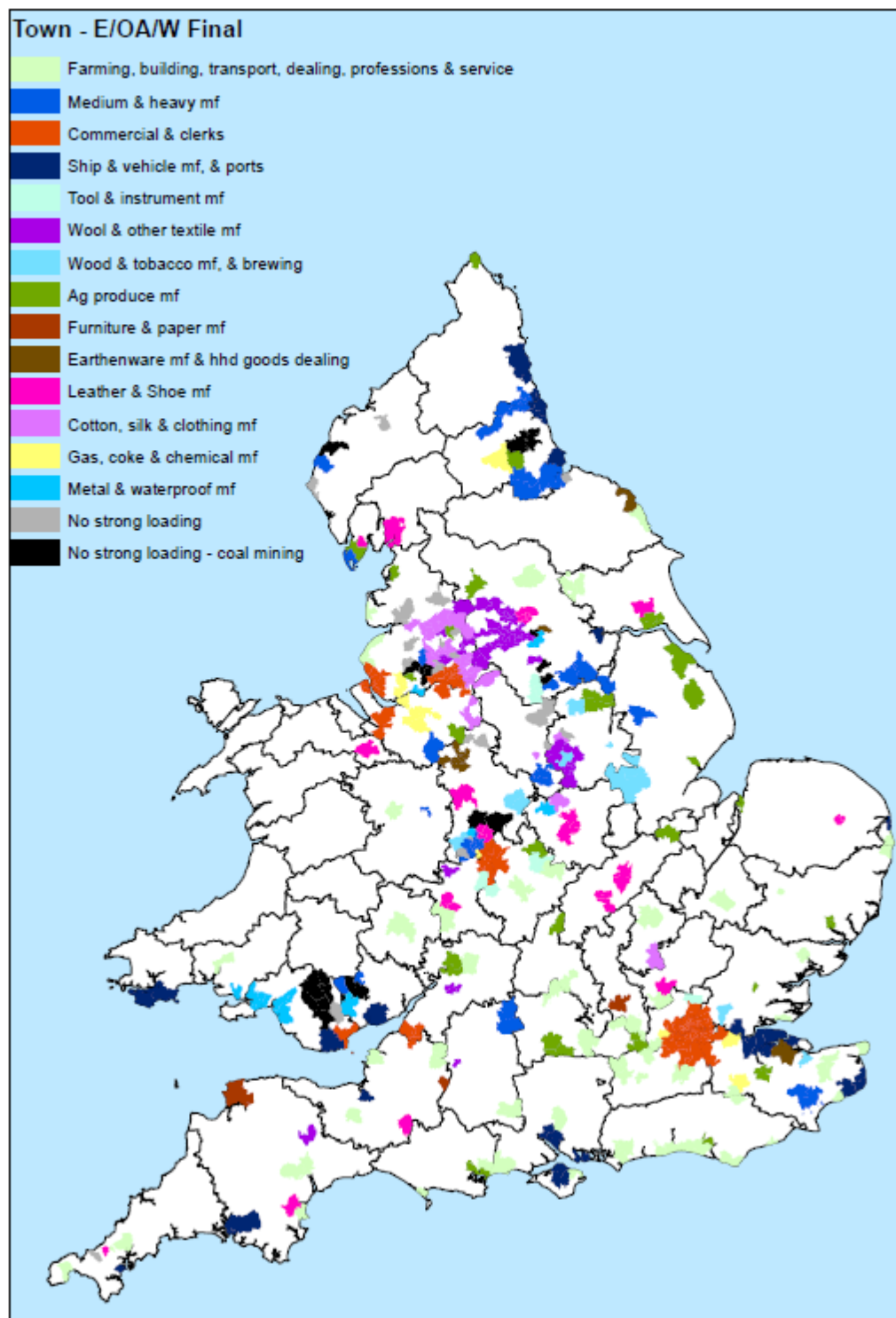
Waterproof goods mf (floor & oil cloth, rubber etc.)

17 towns which are either mainly major trading centres with a high level of manufactures (Lancaster, Carlisle, Swansea, Warrington), or in S. Wales mining regional centres: Abercarn, Carlisle, Coalville, East Retford, Egham, Lancaster, Llanelli, Mountain Ash, Nantyglo, Blaina & Abertillery, Neath, Normanton, Nuneaton, Peterborough, Port Talbot, Rugby, Swansea, Warrington. Several have high loadings on other factors. This factor is retained in the final analysis.

### **Additional Coal Mining Factor:**

In those towns having no strong loading were 18 towns which, although having no loading on any factor at over 0.5, nevertheless have a strong similarity as major coal mining areas. It appears that coal mining, although dominant in each case, is mixed with a range of other different occupations which the factors analysis is unable to separate. These towns were classified to their own factor as a 'directed' decision within the analysis. There were: Aberdare, Ashton-in-Makerfield, Atherton, Brownhills, Cannock, Ebbw Vale, Hetton-Le-Hole, Hindley, Hoyland Nether, Leigh, Maryport, Merthyr Tydfil, Rawmarsh, Rhondda, Stanley, Tyldesley, Wombwell. This includes most major mining centres, especially in S. Wales. This group is retained as a separate classification 'coal mining' to retain their specific character. Whilst not identified strongly from the factor analysis as distinct on any specific sector, they have the common characteristic of a similar occupational pattern to the national population but with a large number of people employed in coal.

The final classification shown in Figure 2 retains 14 of the original factors, reallocates the towns in factors 11 and 13, adds a no strong loading category, and adds the special category of coal mining.



**Figure 2.** Mapping of the classification of each town for all occupied: ‘final’ factor analysis classification.

### 3.2 All occupied: females only

The analysis in Figures 1 and 2 is for all occupied, both male and female. It is important to investigate within this whether there are specific characteristics for the female-only occupied population. The factor variance for analysis of the female only all occupied in Table 3 shows strong dominance by factor 1, and then followed by factors 2 to 5 or 6, after which the tail off is slow. Factor beyond about 10 appear to add little explanation; but as with the all occupied there is considerable complexity and small number issues. Note that because the proportion of females occupied for most categories is small, there is little difference of male only from the total of both genders so that this is not reported here.

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.59723	2.90367	0.1119	0.1119
Factor2	2.69356	0.50466	0.0539	0.1658
Factor3	2.18890	0.15773	0.0438	0.2096
Factor4	2.03116	0.18092	0.0406	0.2502
Factor5	1.85024	0.16940	0.0370	0.2872
Factor6	1.68084	0.03460	0.0336	0.3208
Factor7	1.64625	0.04543	0.0329	0.3538
Factor8	1.60081	0.02928	0.0320	0.3858
Factor9	1.57153	0.03074	0.0314	0.4172
Factor10	1.54080	0.01658	0.0308	0.4480
Factor11	1.52421	0.02363	0.0305	0.4785
Factor12	1.50058	0.01292	0.0300	0.5085
Factor13	1.48766	0.04810	0.0298	0.5383
Factor14	1.43956	0.14545	0.0288	0.5671
Factor15	1.29412	0.02025	0.0259	0.5929
Factor16	1.27387	0.02745	0.0255	0.6184
Factor17	1.24642	0.01306	0.0249	0.6434
Factor18	1.23336		0.0247	0.6680

**Table 3.** Factor variance for all economically occupied females.

Number of obs = 307

Method: principal-component factors Retained factors = 18

Rotation: orthogonal varimax (Kaiser off) Number of params = 747

LR test: independent vs. saturated: chi2 (1225)= 7299.56 Prob>chi2 = 0.0000

**Table 4.** Factor loadings for all economically occupied females (see following page).

SOID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18
farming, fishing, market gardeners, h	0.2366	-0.0616	-0.1126	-0.0259	0.0258	-0.25	0.2383	-0.0316	-0.0436	0.4331	0.1232	-0.1808	-0.0127	-0.2177	0.2722	-0.0921	0.0776	0.0604
coal mining	-0.0841	-0.004	-0.0536	-0.013	-0.2081	-0.04	-0.1162	-0.0206	0.0159	0.4297	0.009	0.2894	-0.1635	-0.0235	-0.1009	-0.0525	-0.2162	0.1743
other mining & quarrying, brickmaki	-0.0159	-0.0218	0.0041	-0.0149	-0.0355	-0.0202	-0.0431	-0.0085	-0.101	0.0283	0.8868	-0.0245	0.0453	0.0651	0.0362	-0.0245	-0.0386	-0.0249
construction operatives (masons, bri	0.0306	0.8658	0.0599	-0.0182	0.0374	0.0006	0.0519	0.0665	-0.0218	0.0068	0.0211	-0.005	0.0564	0.0367	-0.0348	-0.0057	-0.0412	-0.0305
machinery mf	0.024	-0.0094	-0.0557	0.0031	0.044	0.7285	0.3226	0.0626	-0.0033	-0.0581	-0.0297	0.0501	0.0529	0.0979	-0.0376	0.2641	-0.0244	0.0923
tool & weapons mf	-0.0343	0.0465	0.0636	0.9494	-0.0165	0.0472	0.0616	0.042	-0.0119	-0.0069	-0.0054	0.0043	0.0136	-0.0089	0.0108	-0.0292	-0.018	0.0401
iron & steel mf, bolts and nails	-0.1161	0.1403	0.0514	-0.0045	-0.0218	0.0534	0.0155	0.0162	0.054	0.0701	0.0342	0.1668	-0.0367	0.6952	0.1698	-0.1774	-0.0011	-0.1432
blacksmiths	0.1767	-0.0311	0.0107	-0.0425	0.118	-0.0717	0.0435	-0.0227	-0.0413	0.0643	-0.0205	0.718	-0.0211	-0.0888	-0.0951	-0.0093	0.0192	-0.012
other metal mf (copper, tin, brass, w	0.058	0.1454	0.0379	0.1053	0.0123	-0.1155	0.2411	-0.0198	-0.0481	0.356	0.1355	-0.1284	0.0483	0.1456	-0.4084	0.0797	0.0167	-0.2108
ship, road & rail vehicle mf	0.0115	0.1109	-0.0177	-0.0394	-0.0473	0.0674	0.7914	-0.0708	0.0207	-0.0106	-0.045	0.0678	-0.0267	0.0248	-0.0562	-0.034	-0.0623	-0.0787
earthenware & glass mf	-0.0952	0.0309	0.9073	-0.0371	-0.0428	-0.01	-0.0554	-0.0361	0.0052	0.0446	0.0039	0.055	-0.0163	0.0218	0.0272	-0.0072	-0.013	-0.0515
gas, coke and chemical mf	0.0343	0.0407	-0.0134	0.0232	0.0965	0.0486	0.0531	-0.0214	0.5203	-0.0172	0.7268	0.0246	0.0455	-0.0223	-0.0439	0.0476	0.0255	0.1319
leather, fur, hair & bone mf	-0.0338	0.0639	0.0238	0.2569	0.011	0.1496	0.7459	0.1596	0.0398	0.0227	0.0272	-0.0072	0.0045	-0.0392	0.1159	0.1003	0.0824	0.1506
wood mf (sawyers, coopers, cane w	-0.0073	0.005	-0.0166	0.0534	-0.0321	0.0512	0.0016	0.8447	-0.0124	0.0645	-0.0091	-0.0159	-0.0314	-0.0315	0.0199	0.0709	0.0059	0.0084
furnishing mf (cabinet makers, frenc	0.3369	0.298	0.1879	0.0081	-0.0294	0.0246	0.1606	0.5819	-0.0256	-0.2516	-0.0344	-0.0579	-0.0546	0.1382	-0.0316	-0.0535	-0.0233	0.0916
printing & paper mf (paper, cardboa	-0.0063	-0.0202	0.0111	0.0789	0.0469	0.0154	0.0024	0.494	0.5803	-0.0982	-0.035	-0.0485	0.1137	-0.061	-0.1208	-0.1155	-0.0016	-0.0508
waterproof goods mf (floor & oil clo	-0.0012	0.1767	0.0245	0.0241	0.0675	0.1342	-0.166	-0.0687	0.0503	0.1868	0.0315	-0.1265	-0.2493	-0.1163	0.1624	0.2063	0.4752	-0.1204
woollen mf (woollen goods, carpets,	-0.2307	-0.0609	-0.0336	-0.0181	0.7368	0.019	-0.0371	-0.042	-0.0515	-0.0197	-0.0612	-0.0484	-0.0775	-0.0275	-0.0705	-0.0869	-0.0881	-0.0588
cotton & silk mf (incl ribbon, weavin	-0.8114	-0.0843	-0.1478	-0.0603	-0.2388	-0.1726	-0.0228	-0.0867	-0.0205	-0.1695	-0.071	-0.1217	-0.0878	-0.1268	0.0043	-0.1025	-0.011	0.0375
other textile mf (flax, hemp, rope, jut	-0.3453	-0.0637	-0.1478	-0.0114	0.4781	-0.0783	0.0097	0.1052	-0.0767	-0.1631	-0.0925	-0.1471	0.1052	0.0832	0.0067	0.2	-0.0409	0.0484
clothing mf (tailors, milliners, hosiery	-0.1813	-0.0395	-0.0467	-0.0354	-0.0556	0.1118	0.059	0.03	-0.0368	-0.0382	0.0307	0.0669	0.0166	-0.0923	-0.0178	0.7522	0.0023	-0.1088
shoe, boot, clog mf	-0.0246	-0.0462	-0.046	0.0019	-0.0633	0.7986	-0.021	0.0394	-0.0509	0.0361	0.045	-0.0596	-0.051	0.0225	-0.0337	-0.0747	0.0995	0.0191
agric produce mf (millers, refiners, b	0.0564	0.0305	0.0132	0.0105	-0.0319	0.0698	0.0449	0.0216	0.0212	-0.0187	0.0827	0.0005	0.062	-0.0711	0.0246	-0.0764	0.0802	0.808
drink & tobacco mf (malsters, brew	0.0857	-0.019	-0.0088	0.0007	0.0014	0.0023	-0.0023	0.0686	0.1334	0.1315	-0.1242	-0.1008	-0.0445	0.2241	0.172	0.4628	-0.2298	0.4433
watch & instrument mf	-0.0041	-0.0084	-0.0209	0.9555	-0.0089	-0.0339	0.0311	0.0098	0.0241	0.0076	0.0036	0.0253	-0.0093	0.0185	-0.0243	0.0119	0.0116	-0.0345
general mf (manufacturers, mechan	0.4844	0.5658	-0.0491	0.0418	0.006	-0.0787	0.0435	-0.0418	-0.1066	-0.145	0.0165	-0.0068	-0.1756	-0.0044	0.0769	0.2293	0.1473	0.0326
ocean, inland and dock transport	0.1353	0.5467	0.0543	-0.032	-0.0332	-0.0177	-0.0512	0.0122	0.0438	0.252	-0.1337	-0.0029	0.2553	0.1153	-0.0286	-0.0914	0.0711	0.0608
road & rail transport	-0.0095	0.6161	-0.2348	-0.0429	-0.0877	-0.0386	-0.1698	-0.0752	0.0613	0.0344	0.0082	0.0485	-0.0038	-0.1829	-0.0562	-0.136	-0.0674	0.0674
coal dealing	-0.004	0.1631	0.0755	0.1937	-0.1386	0.0525	0.0751	-0.1437	0.1313	-0.0441	-0.0327	0.5885	0.1277	0.1168	0.0811	0.0988	0.0344	-0.0499
timber, hay, corn and agric produce	0.1837	-0.0282	0.0125	0.1321	-0.0231	-0.1354	0.0508	0.2464	0.0942	-0.2172	0.0995	0.3775	-0.0128	0.0781	0.0534	0.1303	0.3574	-0.0015
clothing and dress dealing (drapers, l	0.7613	-0.082	-0.0664	-0.0845	-0.1515	0.0848	-0.0305	0.0481	-0.0635	0.1085	0.0642	0.1359	0.2265	0.0656	-0.0085	-0.0125	0.0916	0.0834
food sales (butchers, fishmongers, c	0.4692	0.1244	-0.064	-0.014	-0.135	-0.0761	-0.046	-0.0607	0.0451	0.0724	0.0863	0.0229	0.603	0.0622	0.1943	-0.1202	0.0326	0.105
lodging & drink sales (wine & spirits	0.4718	0.0039	-0.0536	0.0004	-0.1182	-0.1921	-0.0802	-0.1841	-0.0542	-0.3095	-0.055	-0.1173	0.0862	0.0312	-0.0926	-0.0071	0.0418	-0.0164
stationary dealing (stationers, publish	0.6455	-0.0899	-0.0308	-0.0428	-0.1551	-0.0383	0.0068	0.0954	0.1342	-0.3571	-0.0118	-0.0687	0.1427	0.0063	-0.0783	-0.0665	-0.0005	0.0582
h/h & personal goods dealer (earthe	-0.002	0.0917	0.9258	0.0687	-0.0496	-0.0287	0.0364	0.0611	-0.018	-0.0532	-0.0082	-0.0287	0.0258	-0.0458	-0.0274	-0.0225	-0.0118	0.0578
ironmongers	0.0524	0.2402	-0.1291	-0.0202	-0.1526	0.0197	-0.0411	0.1656	0.0162	-0.0529	0.1448	0.1578	0.4737	-0.1616	0.295	-0.049	-0.1213	-0.2468
other retail (general shopkeeper, huc	0.0315	-0.0043	-0.0051	-0.0117	0.4735	0.0322	-0.0406	0.0676	-0.0774	-0.0345	0.0423	0.3095	0.0232	-0.0248	-0.1354	-0.1475	-0.1077	0.1573
chemists, druggists	0.0851	-0.0256	-0.0157	-0.0116	0.0153	-0.0419	0.0279	-0.0575	0.8401	0.0305	0.0574	0.0324	0.0247	0.0482	0.0311	0.0173	0.0085	0.0259
merchants, banks, insurers and brok	-0.0593	0.7256	0.4137	0.1523	-0.0022	0.0165	0.2643	0.0701	0.0022	-0.0178	0.0074	0.0404	0.1056	0.1576	-0.0124	-0.0108	-0.0195	-0.001
other commerce (accountants, sales	0.1839	0.1105	0.1914	0.048	0.0139	0.0393	0.0366	-0.0881	0.1261	-0.0767	0.0844	-0.0413	0.6065	-0.0751	-0.212	0.1711	0.055	0.1119
construction management (builders &	0.1982	0.0858	0.1732	0.1033	-0.0005	0.4553	0.0251	-0.096	0.1179	-0.1597	-0.0688	-0.1549	0.0057	-0.1524	0.1567	-0.0499	-0.3215	-0.061
professions (barristers, solicitors, sci	0.1379	0.0272	-0.0783	0.0218	-0.0469	0.0457	-0.0101	-0.0199	-0.0152	-0.1106	0.0689	-0.1591	-0.0075	0.73	-0.0894	0.0882	0.0303	0.0636
professions (doctors, dentists, artists,	0.8841	0.0011	-0.0709	-0.0456	-0.12	-0.0593	-0.0115	0.0008	0.0289	0.0379	-0.017	0.0351	0.0897	-0.0514	0.1549	-0.065	0.0231	0.0179
personal services (washing & bathin	0.7173	-0.0436	-0.0983	-0.015	-0.1541	-0.0529	0.0434	0.0763	-0.0901	-0.3192	-0.0116	-0.0533	-0.2921	0.001	-0.026	-0.0672	0.0745	0.0711
Public admin, clergy	0.5603	0.1495	-0.0377	0.024	-0.0331	-0.0116	-0.0942	-0.0814	0.0911	0.3228	-0.0861	-0.0443	0.2199	-0.1195	0.0843	-0.0855	0.0823	-0.0007
Military	0.1634	-0.0548	0.0167	-0.003	0.0176	-0.0535	0.0641	-0.0223	-0.0286	0.0478	0.0268	-0.0657	0.0414	0.0735	0.7678	0.039	-0.0045	0.0359
Clerks, weighers, telegraph, non-the	0.7073	0.1521	0.0099	0.0369	-0.1284	0.0134	0.0692	0.0184	0.1191	-0.3039	-0.0437	-0.0874	-0.1176	-0.0098	-0.0401	-0.0349	-0.0785	0.0315
Domestic and service staff, cooks	0.6601	0.0537	-0.1169	-0.0215	-0.1782	-0.09	-0.0506	-0.0998	0.0789	0.3148	-0.0715	0.0549	0.0642	-0.114	0.0456	-0.0782	-0.0421	-0.1239
Labourers & transport staff (includi	-0.2385	0.0894	-0.1389	-0.0421	0.6906	-0.0595	-0.0007	-0.0662	0.2363	0.085	0.1282	0.0795	-0.0765	-0.0682	0.1361	0.0214	0.1104	-0.0332
Persons of property and unoccupied	0.1464	-0.0726	-0.0445	-0.0238	-0.0525	0.0428	0.0417	-0.0068	0.0123	-0.0468	-0.0733	0.0456	0.0705	0.0398	-0.0469	-0.1066	0.7304	0.103

The factor loadings are strongly grouped on the first factor, after which most factors are dominated by one or two occupational groups, usually with a very high loading of 0.8 or 0.9 showing strong spatial concentrations. This is also clear from the mapping (Figure 3).

The factors can be summarised|:

**Factor 1 (clothing, lodging etc.):**

Clothing and dress dealing (drapers, hosiers, haberdashers)

Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)

Stationary dealing (stationers, publishers, newsagents) – often associated with post mistresses

Professions (doctors, dentists, artists, performers, education)

Personal services (washing & bathing, hairdressing, chimney sweeps)

Public admin, clergy

Clerks, weighers, telegraph, non-theological students and apprentices

Domestic and service staff, cooks

Strong negative loading on:

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

This factor brings out the main female businesses in smaller centres and resorts.

**Factor 2 (building and general mf.):**

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

General mf (manufacturers, mechanic, artisan, machinist)

Ocean, inland and dock transport

Road & rail transport

Merchants, banks, insurers and brokers

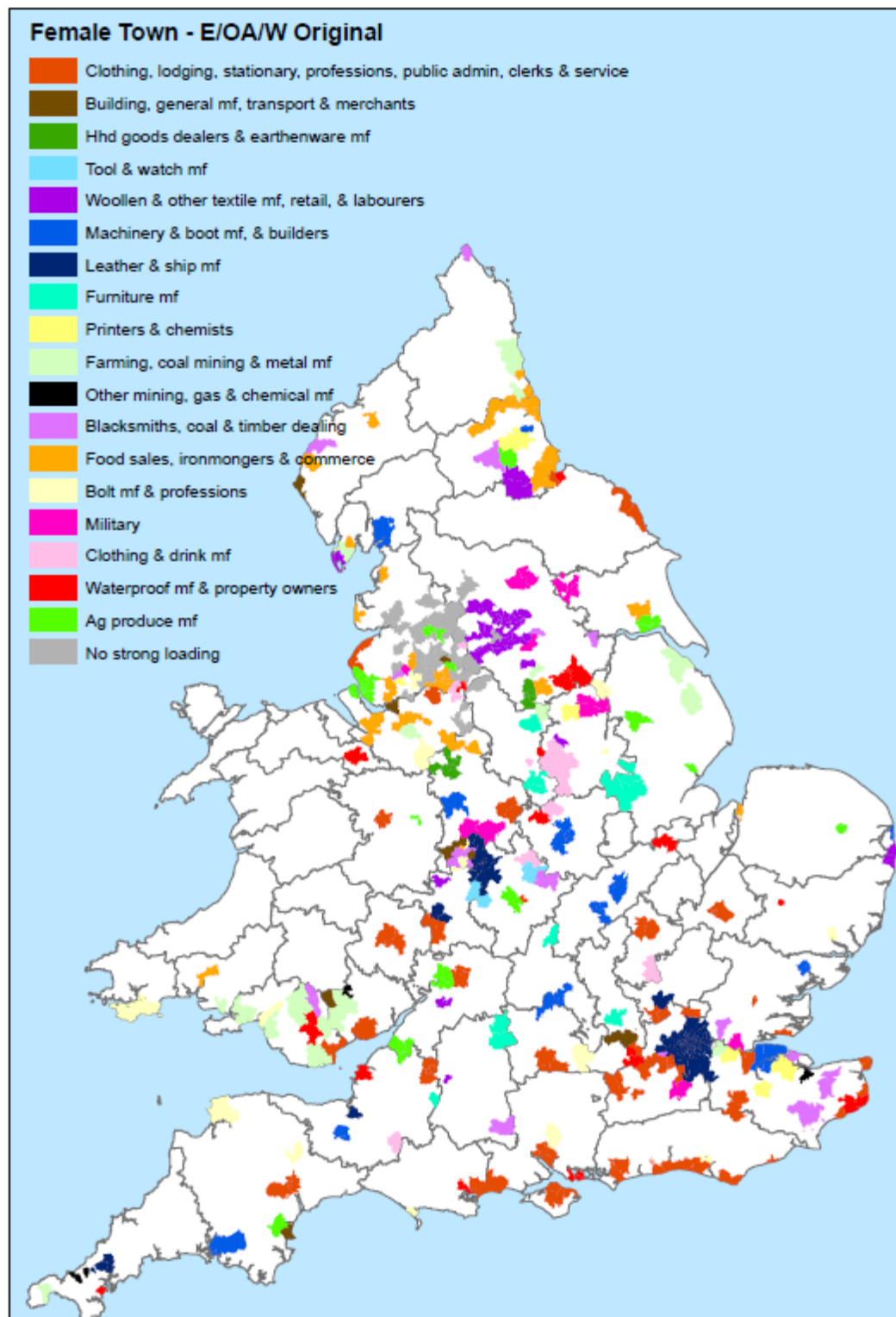
This factor brings out the female ancillary roles in small trades where a husband has died or often where a female is operating a business with male kin. It is distinctive to only a few towns.

**Factor 3 (earthenware and Hhd goods):**

Earthenware & glass mf

H/h & personal goods dealer (earthenware, glass, jewellers)

This brings out the potteries area of Staffordshire which has a high concentration of female work.



**Figure 3.** Mapping of the classification of each town for all occupied: ‘original’ factor analysis classification; females only.

**Factor 4 (tools and watch mf.):**

Tool & weapons mf

Watch & instrument mf

**Factor 5 (woollen and other textiles):**

Woollen mf (woollen goods, carpets, blanket, flannel)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Other retail (general shopkeeper, huckster, hawker)

Labourers & transport staff (including family on farms)

**Factor 6 machine and boot mf.):**

Machinery mf

Shoe, boot, clog mf

Construction management (builders and contractors)

**Factor 7 (ship and leather mf.):**

Ship, road & rail vehicle mf

Leather, fur, hair & bone mf

**Factor 8 furniture mf.):**

Furnishing mf (cabinet makers, french polishers, undertakers)

**Factor 9 printing and chemists):**

Printing & paper mf (paper, cardboard, printers, bookbinders)

Chemists, druggists

**Factor 10 (farming, coal mining and metal mf.):**

Farming, fishing, market gardeners, horse breeding and keeping

Coal mining

Other metal mf (copper, tin, brass, whitesmiths, etc.)

An important female group where females are often interlinked with male mining activities, and may take over mining as employers as widows.

**Factor 11 (non-coal mining, gas & chemicals):**

ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.



Other mining & quarrying, brickmaking, gravel, salt works  
Gas, coke and chemical mf

**Factor 12 (blacksmiths etc.):**

Blacksmiths  
Coal dealing  
Timber, hay, corn and agric produce dealing

**Factor 13 (food sales and ironmongery):**

Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)  
Ironmongers  
Other commerce (accountants, salesmen, travellers, officers of cos.)

**Factor 14: (bolt mf.)**

Iron & steel mf, bolts and nails  
Professions (barristers, solicitors, scientific pursuits)

**Factor 15 (military):**

Military  
Negative on:  
Other metal mf (copper, tin, brass, whitesmiths, etc.)

This factor relates to very small female samples with some miscoding into the military category. All are reassigned to other factors.

**Factor 16 (clothing and drink mf.):**

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)  
Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

**Factor 17 (waterproof goods & property owners):**

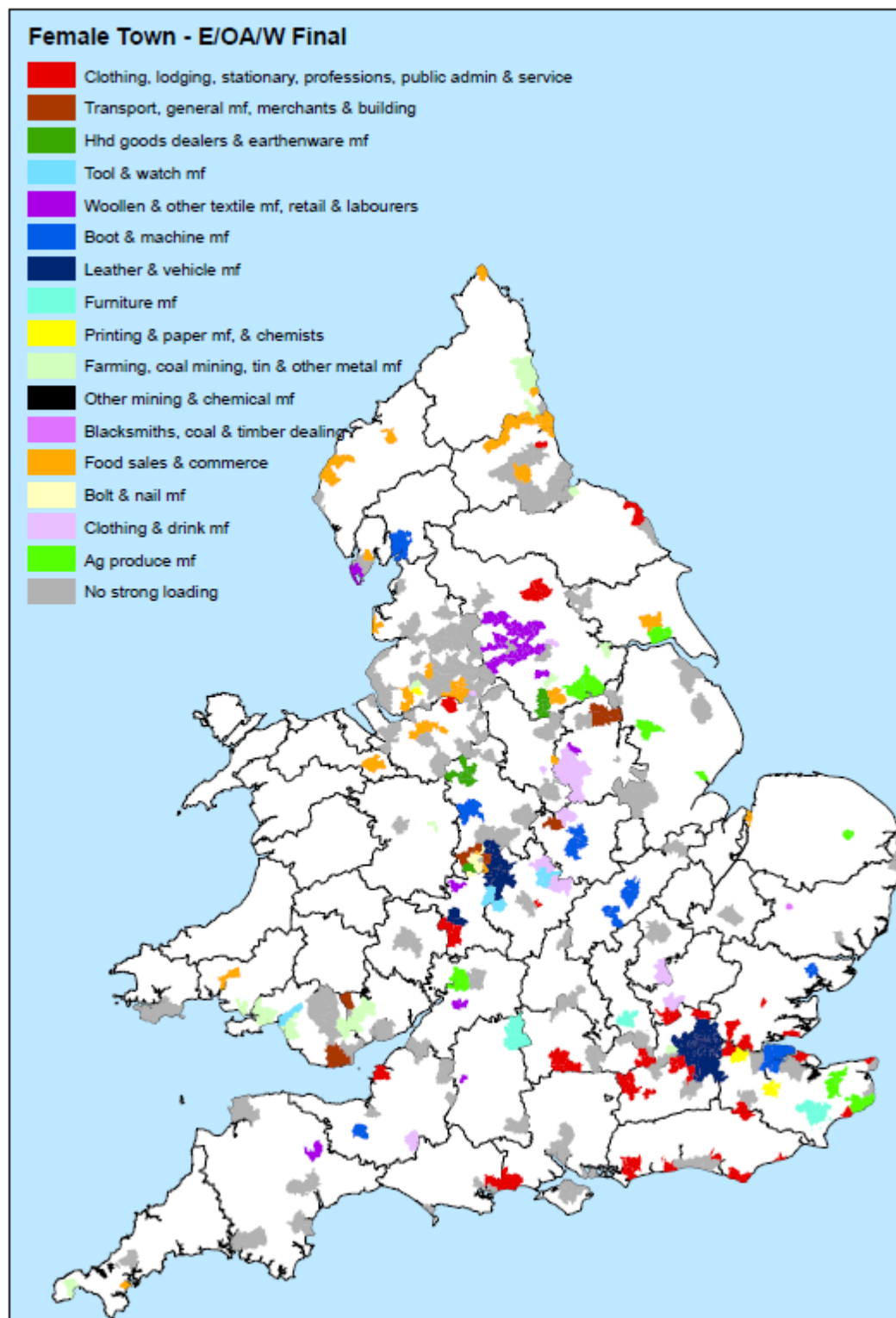
Waterproof goods mf (floor & oil cloth, rubber etc.)  
Persons of property and unoccupied

This factor relates to small female samples with person of property a weak differentiator. All are reassigned to other factors

**Factor 18 (agric. produce mf.):**

Agric produce mf (millers, refiners, bakers, confectioners)

After reassigning all small samples and low loadings, and reassigning the whole of factors 15 and 17, the directed factor analysis final mapping is shown in Figure 4.



**Figure 4.** Mapping of the classification of each town for all occupied: ‘final’ factor analysis classification; females only.

#### 4. Classification of towns for employers only

For employers only we are dealing with much smaller sample sizes than all occupied. The factor variance (Table 5) is heavily concentrated on the first three factors, and little added explanation after about Factor 9 (Table 6), although for loadings may be useful to include for the special cases on Factors 11 for Clothing mf, and Factor 13 for earthenware & glass mf.

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	11.20818	8.45572	0.2242	0.2242
Factor 2	2.75245	0.10393	0.0550	0.2792
Factor 3	2.64853	0.51249	0.0530	0.3322
Factor 4	2.13604	0.17763	0.0427	0.3749
Factor 5	1.95841	0.13298	0.0392	0.4141
Factor 6	1.82544	0.21720	0.0365	0.4506
Factor 7	1.60824	0.01362	0.0322	0.4827
Factor 8	1.59462	0.08823	0.0319	0.5146
Factor 9	1.50638	0.26144	0.0301	0.5448
Factor 10	1.24494	0.00455	0.0249	0.5697
Factor 11	1.24039	0.00269	0.0248	0.5945
Factor 12	1.23770	0.00094	0.0248	0.6192
Factor 13	1.23677	0.09259	0.0247	0.6440
Factor 14	1.14418	-	0.0229	0.6668

**Table 5.** Factor variance – Employers only.

Number of obs = 307

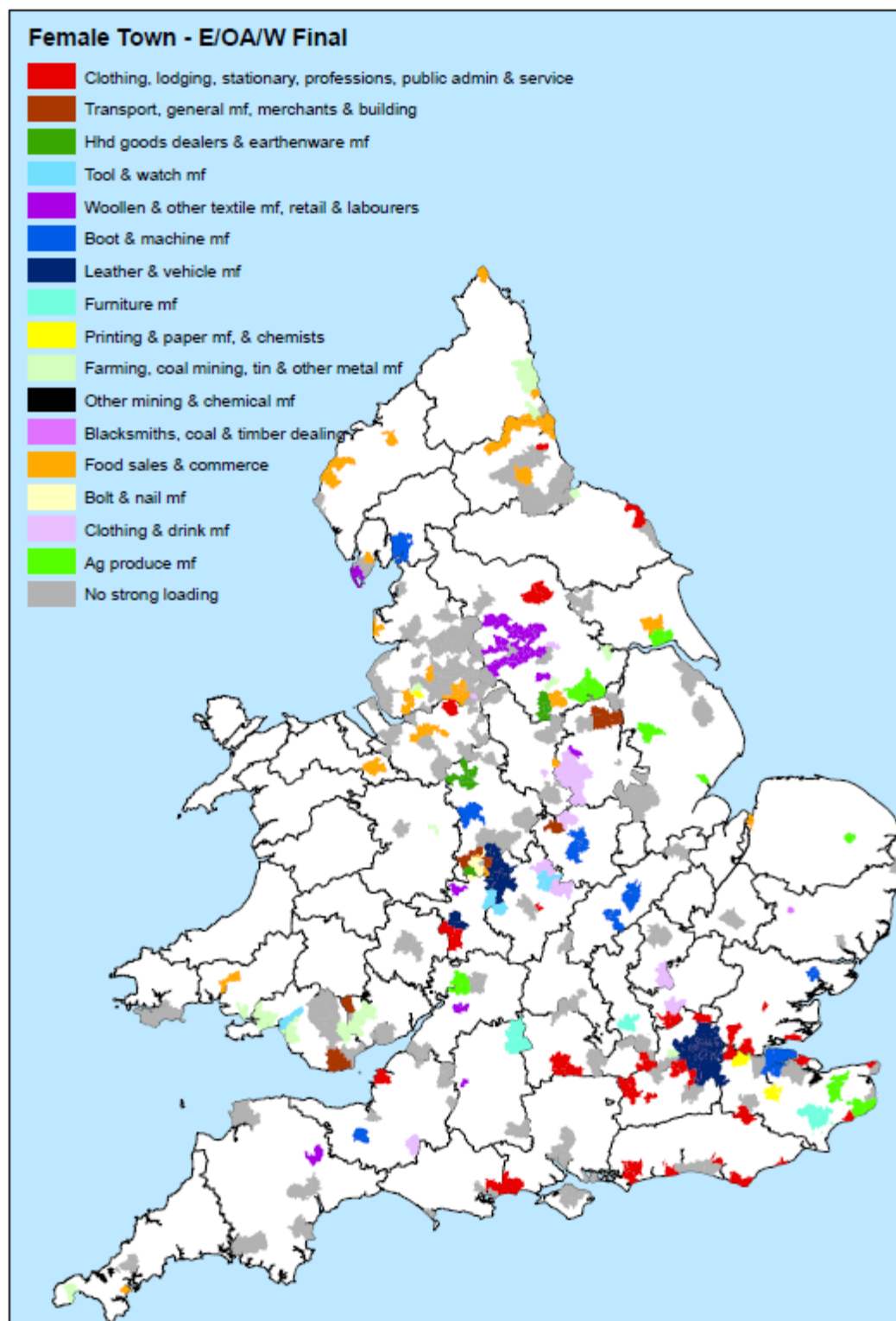
Method: principal-component factors Retained factors = 14

Rotation: orthogonal varimax (Kaiser off) Number of params = 609

LR test: independent vs. saturated:  $\chi^2(1225) = 7778.71$  Prob> $\chi^2 = 0.0000$

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14
1	farming, fishing, market gardeners, horse breeding and keeping	0.3752	0.2892	-0.051	0.5412	-0.0342	0.1869	0.0256	-0.1296	-0.0552	-0.1306	0.0422	-0.2846	-0.1807	-0.0595
2	coal mining	-0.2696	-0.1232	-0.1849	-0.0475	-0.0027	0.6198	-0.0038	-0.0115	-0.1313	-0.0366	-0.0398	-0.0278	0.1039	-0.0098
3	other mining & quarrying, brickmaking, gravel, salt works	-0.073	0.0487	0.0837	0.1187	0.039	0.7707	0.032	-0.006	0.0701	0.1472	-0.0705	-0.0575	-0.0886	0.0059
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.5368	0.1987	0.2378	0.1087	0.172	0.1322	-0.0758	0.1305	0.0227	-0.0885	-0.0041	-0.1322	-0.0799	0.0232
5	machinery mf	0.0363	0.1442	0.7231	0.037	0.2034	0.0428	0.0549	0.0916	0.1511	0.0568	0.1031	0.062	0.1477	-0.0571
6	tool & weapons mf	-0.0211	-0.0073	0.0936	-0.0515	-0.0249	0.0821	-0.051	0.8801	-0.0044	0.0006	0.0178	0.0397	-0.0042	-0.0492
7	iron & steel mf, bolts and nails	-0.2095	-0.0344	0.283	-0.0035	-0.1391	0.4574	-0.1874	0.2191	-0.0317	-0.0869	-0.102	0.2823	0.1889	0.0371
8	blacksmiths	0.371	0.1323	-0.06	0.6288	-0.0217	0.3437	-0.0016	0.0074	-0.0138	-0.0477	-0.0202	0.036	-0.0571	0.0785
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	-0.1038	0.1112	0.6925	-0.0509	0.0054	0.0497	-0.0564	0.0551	0.0179	-0.1309	-0.0567	-0.0431	-0.1566	0.0925
10	ship, road & rail vehicle mf	0.6085	0.0161	0.1515	0.3613	-0.1223	-0.0266	-0.0312	0.0299	0.2978	0.0075	-0.0139	0.0713	-0.0402	-0.0499
11	earthenware & glass mf	0.0752	0.1003	-0.0092	-0.0289	-0.0953	-0.0079	-0.0179	-0.0519	0.0141	-0.0435	-0.0297	-0.0274	0.8315	-0.0345
12	gas, coke and chemical mf	0.2403	0.5759	0.0878	0.0183	0.0916	-0.0928	0.0604	-0.0442	0.0372	0.2694	-0.0633	-0.0346	0.0906	0.3066
13	leather, fur, hair & bone mf	0.3272	-0.0225	0.6725	0.1009	0.109	-0.0791	0.2542	0.03	-0.1762	0.0354	0.0118	-0.0316	-0.022	-0.08
14	wood mf (sawyers, coopers, cane workers)	0.2388	0.038	0.2444	0.4227	-0.0102	-0.2544	-0.0629	0.0975	-0.0102	-0.01	0.4884	0.0519	0.2633	0.0838
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.4571	-0.0972	0.1714	0.1497	0.0691	-0.1396	-0.1211	0.0615	-0.0676	0.04	-0.0494	0.1326	-0.043	0.1497
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.5142	0.356	0.3754	0.1007	0.0749	-0.096	0.2509	0.0908	-0.0308	0.0833	0.07	-0.1093	0.0875	0.0903
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.0189	0.1107	0.2813	0.1322	-0.0131	-0.0634	0.7113	0.0994	0.0091	-0.035	-0.1396	-0.0819	-0.0598	0.0842
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.0405	0.0546	0.385	-0.0947	0.5672	0.1021	-0.0342	-0.1398	-0.1132	0.0042	-0.0175	-0.1296	-0.1157	-0.0383
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.2655	0.4456	0.0905	-0.0324	-0.0465	-0.3038	-0.1533	-0.0125	-0.137	-0.0406	-0.0697	-0.2116	-0.3231	-0.0017
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.0178	0.2182	0.1544	0.0502	0.8148	-0.09	0.0081	-0.0155	-0.0763	-0.0427	0.0336	-0.0587	-0.0707	0.0314
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, k	-0.0282	0.0188	-0.0088	-0.0225	-0.0026	-0.0361	-0.0188	-0.0005	-0.0206	0.0196	0.8909	0.0188	-0.0544	0.0633
22	shoe, boot, clog mf	0.3797	-0.1675	0.1964	0.0365	-0.1247	0.0145	0.2338	-0.1358	-0.1978	0.0094	0.0823	-0.0636	-0.1815	-0.2847
23	agric produce mf (millers, refiners, bakers, confectioners)	0.2893	-0.1072	0.0717	0.6526	0.1896	-0.058	0.1728	0.0154	0.1448	0.1565	-0.015	0.0351	0.0139	-0.0774
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.6082	-0.158	0.2099	0.2542	0.0063	-0.2178	0.0172	0.1253	-0.0503	0.2092	-0.0509	0.0353	0.191	0.0377
25	watch & instrument mf	0.3722	0.0457	-0.0079	0.0979	0.025	-0.1235	0.2009	0.7336	-0.0273	0.028	-0.0015	-0.0978	-0.0612	0.0323
26	general mf (manufacturers, mechanic, artisan, machinist)	0.1657	0.6054	0.0506	0.0114	0.0453	0.0419	-0.0992	0.205	0.2661	-0.0422	0.1372	0.1175	0.0974	-0.2
27	ocean, inland and dock transport	0.2218	0.132	-0.0401	0.0987	-0.0355	-0.0281	-0.0173	-0.0408	0.8248	-0.0224	-0.0774	-0.0045	0.0099	-0.051
28	road & rail transport	0.7784	0.1407	-0.0699	-0.0898	-0.0252	0.0746	0.0196	-0.0394	0.0597	-0.0859	-0.0753	-0.1363	-0.0479	0.0953
29	coal dealing	0.5269	0.0197	0.3274	0.1048	-0.0594	-0.1482	-0.2762	0.0745	0.1388	-0.0033	-0.0915	0.1284	-0.0921	0.1212
30	timber, hay, corn and agric produce dealing	0.6099	0.0909	0.1413	0.4329	-0.006	-0.1466	-0.0397	0.0708	0.1121	0.1574	0.0277	0.1559	0.1096	0.0052
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.834	-0.0288	0.1707	0.1212	0.0312	-0.025	-0.0215	0.0872	-0.0512	0.0842	0.1091	-0.0359	-0.0099	0.0367
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	0.8778	0.0448	0.0013	0.2482	-0.024	-0.0903	-0.0026	0.022	0.1471	0.0253	0.047	0.0038	0.055	0.0022
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.8089	-0.0032	-0.0763	0.0244	-0.0128	-0.0587	-0.0836	0.0399	0.0799	-0.097	-0.0303	-0.0161	0.064	-0.0259
34	stationery dealing (stationers, publishers, newsagents)	0.8674	0.1409	0.0477	-0.0494	0.0072	-0.1058	0.0737	-0.0097	-0.0366	0.001	-0.0135	0.0636	-0.0537	0.0593
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.3523	-0.029	0.1861	-0.1426	0.0135	0.1227	0.0211	0.0331	0.5346	0.0021	0.1879	-0.1378	0.0445	-0.0178
36	ironmongers	0.6804	0.0119	0.1963	0.2493	-0.0549	0.012	-0.0076	0.0797	0.0802	0.2504	0.0468	0.0588	0.0006	-0.0902
37	other retail (general shopkeeper, huckster, hawker)	-0.065	-0.0956	-0.0344	0.0306	0.852	0.0569	0.0009	0.0386	0.0615	0.0175	-0.0287	0.103	0.0065	-0.0239
38	chemists, druggists	0.7559	-0.1379	0.085	0.2478	-0.012	-0.1382	-0.0302	0.1006	-0.0214	-0.0113	-0.0168	-0.0851	0.0613	-0.0325
39	merchants, banks, insurers and brokers	0.3376	0.7679	0.0497	0.0671	0.0709	0.0563	0.2027	-0.0393	0.0805	-0.0364	0.0123	0.114	0.0339	-0.0288
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.669	0.4683	0.1575	0.0718	0.0126	-0.0735	0.2111	0.0213	0.0401	-0.0649	0.0259	0.0229	0.0827	0.0713
41	construction management (builders and contractors)	0.8049	0.132	-0.1045	0.0758	-0.034	0.1614	0.1298	-0.0045	0.1484	0.0953	0.0016	0.1236	0.0289	0.0213
42	professions (barristers, solicitors, scientific pursuits)	0.6803	0.4398	0.1125	0.1263	0.0065	-0.0238	0.2199	-0.0116	0.0802	0.0882	0.0065	0.1151	0.0325	-0.0802
43	professions (doctors, dentists, artists, performers, education)	0.8833	0.1592	-0.0046	0.0011	0.0492	0.0013	0.0359	0.0384	0.0724	0.0226	0.0063	-0.0609	0.0342	-0.0279
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.8262	0.0804	-0.1371	-0.0689	-0.039	0.0165	0.0515	-0.0173	-0.0182	0.0333	0.0232	0.0739	-0.0176	0.0989
45	Public admin, clergy	0.1349	0.1804	-0.0658	0.076	0.0793	-0.0213	-0.0155	-0.0312	-0.0988	-0.152	0.1053	0.619	0.0146	-0.0585
46	Military	0.0949	0.0937	0.0712	-0.1528	-0.0399	-0.0372	0.173	-0.0691	0.0132	-0.1824	-0.0382	0.4996	-0.1415	0.0023
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.1689	0.1605	-0.1	-0.0478	-0.0008	0.0974	0.661	0.0128	-0.0275	-0.09	0.0808	0.1826	0.0397	-0.0711
48	Domestic and service staff, cooks	0.2081	0.4096	0.2192	-0.1383	0.1104	0.0282	-0.149	-0.0187	-0.2386	-0.0335	-0.067	-0.2855	0.1634	-0.0651
49	Labourers & transport staff (including family on farms)	0.1132	-0.0257	-0.0095	-0.011	-0.0153	0.0138	0.0111	-0.0328	-0.0546	-0.0327	0.0893	-0.0156	-0.0338	0.8687
50	Persons of property and unoccupied	0.1077	0.0125	-0.0236	0.0244	-0.0163	0.0691	-0.0513	0.0124	-0.0203	0.896	0.0197	-0.0182	-0.0354	-0.0258

Table 6. Factor loadings – Employers only



**Figure 5.** Mapping of the classification of each town for employers only: ‘original’ factor analysis classification.

The factors can be summarised:

**Factor 1 (professionals and dealers) [\* same as Factor 1 for all occupied]:**

- \*Construction operatives (masons, bricklayers, thatcher, plumbers etc.)
- Ship, road & rail vehicle mf
- Furnishing mf (cabinet makers, french polishers, undertakers)
- Printing & paper mf (paper, cardboard, printers, bookbinders)
- Shoe, boot, clog mf
- \*Road & rail transport
- Coal dealing
- \*Timber, hay, corn and agric produce dealing
- \*Clothing and dress dealing (drapers, hosiers, haberdashers)
- \*Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)
- \*Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)
- \*Stationery dealing (stationers, publishers, newsagents)
- \*Ironmongers
- \*Chemists, druggists
- \*Other commerce (accountants, salesmen, travellers, officers of cos.)
- \*Construction management (builders and contractors)
- \*Professions (barristers, solicitors, scientific pursuits)
- \*Professions (doctors, dentists, artists, performers, education)
- \*Personal services (washing & bathing, hairdressing, chimney sweeps)

Mapped these are chiefly resorts with a few other traditional county towns (N=34). The strongest loadings are for 20 of these: Bath, Blackpool, Bournemouth & Poole, Brighton & Hove, Blackpool, Eastbourne, Folkestone, Harrogate, Hastings, Malvern, Margate, Ramsgate, Royal Leamington Spa, Royal Tunbridge Wells, Salisbury, Scarborough, Torquay, Weston-super-Mare, Worthing, Wrexham.

**Factor 2 (commerce, silk, gas and chemicals):**

- Gas, coke and chemical mf
- Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)
- General mf (manufacturers, mechanic, artisan, machinist)
- Merchants, banks, insurers and brokers
- Domestic and service staff, cooks

These are 25 Lancs. and Cheshire towns strong in textiles (cotton and silk), plus Southend, Southport, Enfield, Teddington and Twickenham. These may be concentrations of absentee owners. Only 15 load above 1.0. Although including chemical, it does not include most of the chemical centres, nor the salt centres at high loading. Also, although including merchants, it does not focus on major commercial centres which are mostly in Factor 1. The highest loaded on this factor almost all load highly on other factors.

### **Factor 3 (machinery and metal mf.):**

Machinery mf

Other metal mf (copper, tin, brass, whitesmiths, etc.)

Leather, fur, hair & bone mf

These are county industrial towns, and Yorks. and W. Midlands heavy industrial and metals areas (n=24). Highest loaded are: Twickenham, Banbury, Birmingham & Smethwick, Chelmsford, Cleckheaton, Halifax, Heckmondwike, Keighley, Walsall. Almost all load highly on this factor; only Norwich and Stroud are below 0.84 (at 0.65 and 0.69, respectively).

### **Factor 4 (farming and rural trades):**

Farming, fishing, market gardeners, horse breeding and keeping

Blacksmiths

Wood mf (sawyers, coopers, cane workers)

Argic produce mf (millers, refiners, bakers, confectioners)

These are 28 towns, similar to Factor 1 as county centres, but often remote and generally with lower levels of commercial functions and professions. Factor 1 is an alternative loading in only a few cases. The highest loaded are Boston, Grimsby, Louth, Newbury, Penzance, Tiverton, Truro, Worksop

### **Factor 5 (wool & other textiles):**

Woollen mf (woollen goods, carpets, blanket, flannel)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Other retail (general shopkeeper, huckster, hawker)

These are 13 textile towns all in W. Riding of Yorks., except Nottingham, Ilkeston, and Kidderminster.



**Factor 6 (Iron and steel mf & retail):**

Coal mining

Other mining & quarrying, brickmaking, gravel, salt works

Iron & steel mf, bolts and nails

Towns with high coal mining for 17 of the 19 cases, but two are centres of other mining or quarrying in Cornwall (Redruth and Camborne)

**Factor 7 (waterproof goods mf):**

Waterproof goods mf (floor & oil cloth, rubber etc.)

A surprisingly large group, although most have only small loadings. The highest loaded are Barnstable, Bexley, Deal, East Retford, Hucknall, Leicester, Nuneaton and Wellingborough. It includes London, though with low loading.

**Factor 8 (tool and instrument mf.):**

Tool & weapons mf

Watch & instrument mf

Only 6 towns: Coventry, Eckinton, Mosborough & Renishaw, Redditch, Sheffield, Whitehaven, Willenhall

**Factor 9 (Hhd goods dealing and ports):**

Ocean, inland and dock transport

H/h & personal goods dealer (earthenware, glass, jewellers)

Port towns (N=25), though not all major ports are included; almost all the rest are under Factor 1.

**Factor 10 (ironmongers and property):**

Ironmongers

Persons of property and unoccupied

Eight towns Bedford, Guildford, Littleborough, Newton Abbot, Reading, Reigate, Wigan, Winchester that combine some retail distribution with concentration of the propertied class.

**Factor 11 (Clothing mf.):**

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

[loads on no other factor]

Seven towns that are mostly recognised centres of small outworkers, though some other such centres are also in Factor 7: Belper, Berwick, Denton, Luton, St. Albans, Sutton in Ashfield, Yeovil. Of these, Luton, Denton, Yeovil, and St. Albans are by far the highest loaded, especially Luton.

#### **Factor 12:**

Public admin, clergy

Military

22 towns usually with strong military presence (naval and army). The public administration functions appear to me mainly related to the military and may reflect some cross-coding in I-CeM: Aberdare, Bilston, Bishop Auckland, Bridgwater, Burton-On-Trent, Bury St Edmunds, Doncaster, Erith\*, High Wycombe\*, Kingston upon Thames\*, Lewes\*, Middlesbrough, Pendlebury, Rotherham, Ryde, Tipton, Warrington, Warwick\*, West Bromwich, Weymouth\*, Winsford\*, Worcester.\* [\* are those most highly loaded]. This factor is reassigned in entirety to second highest scores or not strong loading.

#### **Factor 13:**

Earthenware & glass mf [loads on no other factor]

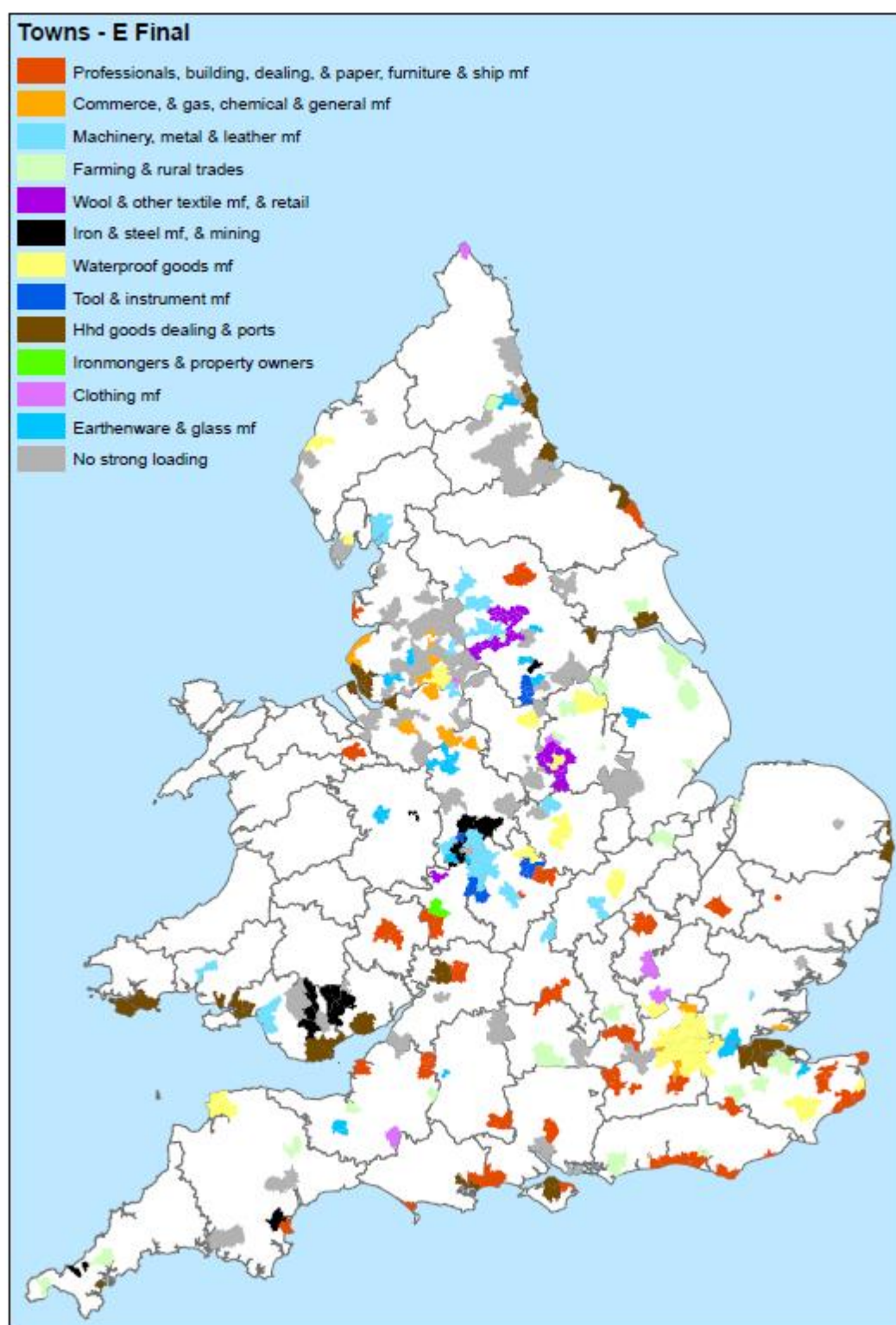
Towns with a strong presence in these two sectors, but also more diversified places (N=24). The most highly loaded are: Brierley Hill, Burslem, Fenton, Hanley, Longton, Stoke-On-Trent, Stourbridge, Tunstall. Next in rank loadings are: Dartford, Grays Thurrock, Newcastle under Lyme. This covers all the main pottery centres of the W. Midlands and quarrying centres in Kent.

#### **Factor 14:**

Labourers & transport staff (including family on farms)

This Factor is not mapped as it relates to employees, with only a few employers in small sample cases. The towns are included in the residual factor mapped as 14, where there is no strong loading; they number 49. This factor is reassigned in entirety to second highest scores or not strong loading.

The final mapping (figure 6) excludes the original factors 12 and 14 and reassigns all small loadings and small samples.



**Figure 6.** Mapping of the classification of each town for employers only: ‘final’ factor analysis classification

## 5. Classification of towns for own account only

The own account entrepreneurs are heavily concentrated on the first factor, with little added explanation for factors above Factor 12 or 13 (Table 7). The loadings (Table 8) and mapping (Figure 7) is in many cases similar to the total for all occupied.

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	7.72597	5.02641	0.1545	0.1545
Factor 2	2.69956	0.65098	0.0540	0.2085
Factor 3	2.04859	0.01755	0.0410	0.2495
Factor 4	2.03103	0.17382	0.0406	0.2901
Factor 5	1.85721	0.17094	0.0371	0.3272
Factor 6	1.68628	0.04639	0.0337	0.3610
Factor 7	1.63989	0.08037	0.0328	0.3938
Factor 8	1.55952	0.04509	0.0312	0.4250
Factor 9	1.51443	0.06479	0.0303	0.4552
Factor 10	1.44964	0.03992	0.0290	0.4842
Factor 11	1.40972	0.11759	0.0282	0.5124
Factor 12	1.29213	0.00592	0.0258	0.5383
Factor 13	1.28621	0.03235	0.0257	0.5640
Factor 14	1.25385	0.00629	0.0251	0.5891
Factor 15	1.24756	0.06430	0.0250	0.6140
Factor 16	1.18326	0.00120	0.0237	0.6377
Factor 17	1.18206	0.04047	0.0236	0.6613
Factor 18	1.14159	-	0.0228	0.6842

**Table 7.** Factor variance – own account occupied only

Number of obs = 307

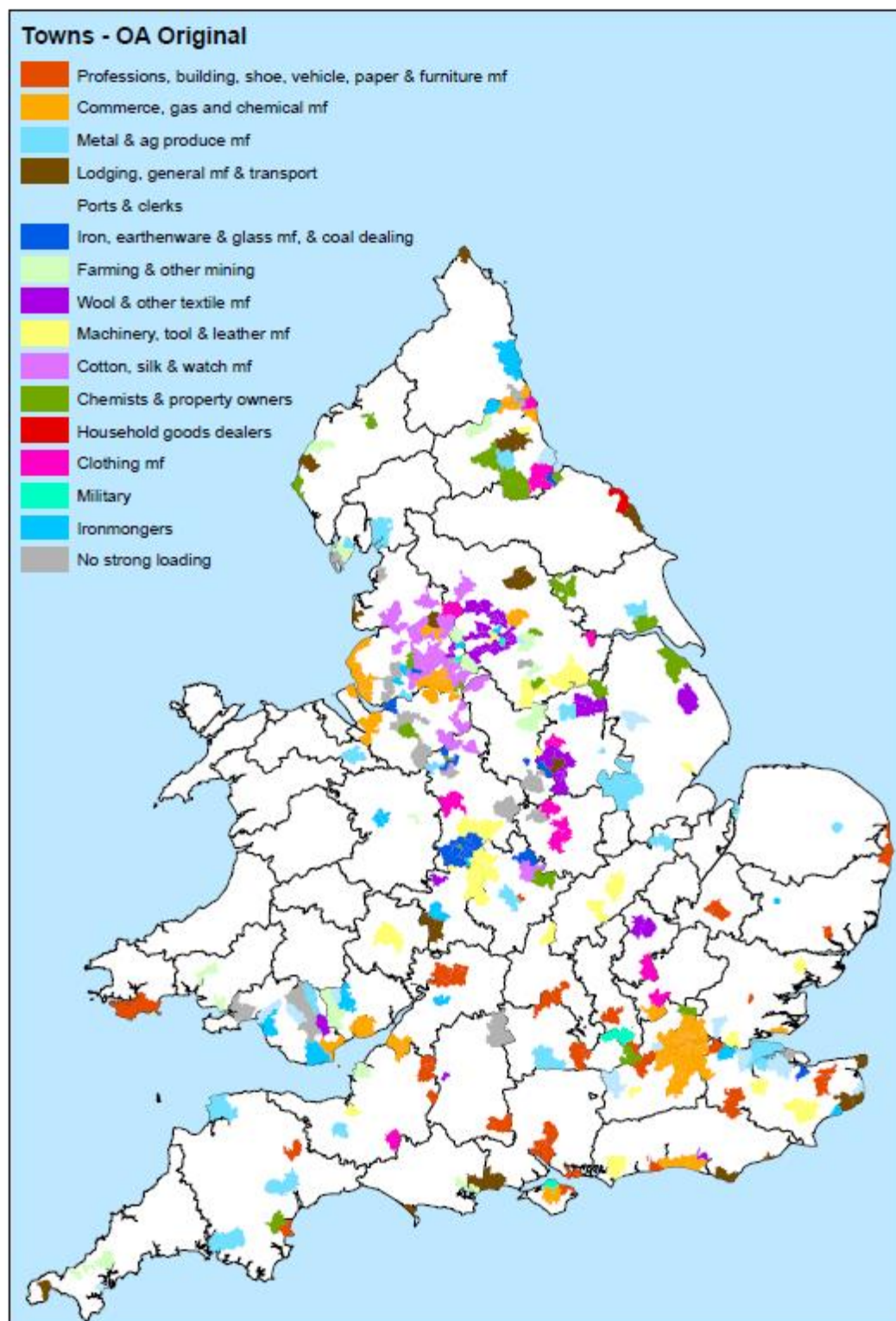
Method: principal-component factors      Retained factors = 18

Rotation: orthogonal varimax (Kaiser off)      Number of params = 747

LR test: independent vs. saturated:  $\chi^2(1225) = 5568.39$  Prob> $\chi^2 = 0.0000$

**Table 8.** Factor variance – Own account only (see following page).

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18
1	farming, fishing, market gardeners, h	0.3731	0.1244	0.0745	0.2853	0.1607	-0.177	0.4962	0.2024	-0.1252	0.2085	-0.0213	0.1085	0.0219	0.0242	-0.07	0.1055	0.0727	-0.1479
2	coal mining	-0.2646	-0.2282	0.0365	-0.0764	0.0204	-0.013	0.2005	-0.1777	-0.0513	-0.2669	-0.1793	0.063	-0.1966	-0.1205	0.0082	-0.3087	-0.0803	0.265
3	other mining & quarrying, brickmaking	0.0186	0.0364	0.1831	0.031	-0.0654	0.057	0.7338	0.0075	0.0485	-0.0564	0.1035	0.0062	-0.1893	-0.0593	0.0112	-0.0995	-0.0235	0.0522
4	construction operatives (masons, brick	0.7681	0.2416	0.012	0.2233	0.2271	0.0049	0.0798	-0.0295	0.0507	-0.0897	-0.0564	-0.0124	0.007	0.0038	0.032	0.0045	0.0212	0.0824
5	machinery mf	0.0917	0.2312	-0.1692	-0.0371	-0.1591	0.2019	-0.0637	0.3222	0.3558	-0.0807	0.0443	0.2172	0.3429	0.0578	0.1491	0.1253	0.1665	0.1888
6	tool & weapons mf	0.2126	-0.1289	-0.0263	-0.0203	0.0698	0.1737	0.0551	-0.0512	0.6696	0.0317	0.1431	-0.0856	-0.1035	0.0372	-0.1281	0.0401	0.0885	-0.1199
7	iron & steel mf, bolts and nails	-0.1703	-0.0291	-0.0463	0.0798	-0.0209	0.7416	0.1094	-0.1016	0.2216	-0.1724	-0.0448	-0.0044	-0.0458	0.0213	-0.1145	0.0183	-0.0424	-0.0304
8	blacksmiths	0.3905	-0.0364	0.2086	0.1604	0.0264	0.0381	0.3042	0.0675	0.0467	-0.1306	-0.4066	0.0804	0.2903	-0.0337	0.0807	-0.034	-0.1666	-0.1776
9	other metal mf (copper, tin, brass, w	0.1666	0.0215	0.5475	0.1263	-0.0712	0.0224	0.2224	0.16	0.1307	-0.0982	0.1015	0.1489	0.1306	-0.0658	0.2338	-0.1759	-0.0154	0.1656
10	ship, road & rail vehicle mf	0.5958	0.1299	0.0695	0.09	0.3183	0.0959	0.0229	-0.0734	0.0698	-0.0417	-0.0894	0.287	0.0362	0.2332	-0.0795	0.024	-0.038	0.1305
11	earthenware & glass mf	0.356	-0.0519	-0.0877	-0.1739	-0.1441	0.4052	-0.0848	0.0709	-0.3285	-0.078	0.1753	0.225	-0.0033	-0.0584	0.0919	0.1592	0.2409	-0.148
12	gas, coke and chemical mf	-0.0169	0.5295	0.1896	-0.0876	0.2742	0.0554	-0.1456	0.019	0.1246	0.0196	-0.239	0.1144	-0.1517	-0.0233	-0.3815	-0.1705	0.0894	-0.0983
13	leather, fur, hair & bone mf	0.2842	-0.0005	0.312	-0.1511	-0.1077	0.0073	0.0238	0.2649	0.4644	0.0597	-0.0718	0.1024	0.0573	0.0284	-0.0191	0.2509	-0.0864	-0.135
14	wood mf (sawyers, coopers, cane w	0.717	-0.0685	0.2443	-0.0568	-0.074	0.116	-0.0808	0.1199	0.0312	0.0823	0.002	-0.024	0.0313	0.0187	-0.0208	-0.0446	0.0415	-0.0426
15	furnishing mf (cabinet makers, frenal	0.7819	0.1209	-0.012	0.1622	-0.0638	-0.0134	-0.1053	0.1113	0.0264	0.0463	-0.0693	-0.031	-0.0773	0.0045	-0.0294	0.0043	0.1395	0.0725
16	printing & paper mf (paper, cardboar	0.4876	0.1572	0.1582	-0.0045	0.1621	-0.1557	-0.166	-0.0232	0.4589	-0.0426	0.0389	0.0869	-0.0512	-0.1511	0.1422	-0.0664	-0.0697	0.0673
17	waterproof goods mf (floor & oil clot	0.0889	0.4406	-0.1901	0.1615	-0.1424	-0.0245	0.0772	0.0314	0.1402	0.0594	-0.0658	-0.1347	0.2482	-0.0712	0.3871	-0.0201	-0.0116	-0.059
18	woollen mf (woollen goods, carpets,	-0.0792	0.0407	0.0436	-0.0256	-0.0118	-0.0309	0.0191	0.7748	0.0372	-0.063	0.0041	-0.033	-0.0549	-0.035	0.1218	-0.0067	0.0007	-0.0562
19	cotton & silk mf (incl ribbon, weaving	-0.2512	0.0538	-0.0234	-0.0072	-0.013	0.0076	0.0092	-0.0017	-0.03	0.8484	-0.0249	0.0232	0.0201	-0.0296	0.0108	-0.0245	-0.0261	0.0011
20	other textile mf (flax, hemp, rope, jute	0.2892	0.0196	0.0469	-0.0197	-0.1185	-0.0132	0.0351	0.5412	-0.1086	0.129	0.0239	-0.0929	-0.0407	0.1035	-0.3172	-0.0736	-0.1414	0.2402
21	clothing mf (tailors, milliners, hosiery,	0.0033	-0.0311	0.1016	-0.0185	0.0057	-0.0232	-0.1078	-0.049	-0.0676	0.0275	-0.0334	-0.0272	0.8081	0.0012	-0.0657	-0.0871	0.0351	-0.0077
22	shoe, boot, clog mf	0.822	-0.0891	0.2057	0.0626	0.1857	0.0716	0.0986	0.0885	0.0533	-0.0042	0.0006	0.065	0.1037	0.0284	-0.0118	0.0133	-0.0257	-0.0034
23	agric produce mf (millers, refiners, b	0.2081	-0.1013	0.6763	-0.0806	-0.0716	0.1035	0.1855	-0.0585	-0.0627	0.0157	0.0049	-0.0693	0.0649	0.0282	0.0044	0.2255	-0.1173	0.0827
24	drink & tobacco mf (malsters, brew	0.4285	0.3557	0.2136	0.0971	-0.0108	0.1886	-0.2954	-0.0771	0.0665	-0.0838	0.1551	-0.0001	-0.1197	-0.0729	-0.0319	0.1585	-0.0207	-0.0983
25	watch & instrument mf	0.5133	-0.0127	-0.0194	0.0507	0.023	0.0521	-0.0719	-0.0445	0.3698	0.5306	0.0281	0.0766	-0.0442	-0.1583	0.0805	-0.0527	-0.0024	0.0127
26	general mf (manufacturers, mechanic	0.2454	0.0528	-0.0892	0.3148	-0.091	0.0054	-0.0389	-0.0565	0.023	0.0289	0.2768	0.147	0.0718	-0.0299	-0.4848	-0.1153	-0.0836	-0.0872
27	ocean, inland and dock transport	0.2834	0.0186	-0.0892	0.1359	0.7796	-0.0471	0.0364	-0.0716	-0.0121	0.0105	0.0564	-0.0189	0.0379	0.0007	0.0977	0.109	-0.0886	0.0288
28	road & rail transport	0.3696	0.0689	-0.0481	0.752	0.025	0.0126	0.1091	0.0308	-0.0273	-0.0604	-0.1511	-0.0458	-0.0208	-0.0223	0.082	-0.0341	0.0387	0.088
29	coal dealing	0.0938	-0.0064	0.1547	-0.0525	0.063	0.79	-0.0819	0.0737	-0.0614	0.1789	0.0189	-0.0526	0.0229	-0.0483	0.0945	-0.1281	-0.0653	0.0756
30	timber, hay, corn and agric produce c	0.4795	0.1001	0.4504	-0.2168	-0.1302	-0.0288	-0.0579	-0.0145	0.0994	-0.012	-0.0564	-0.1425	-0.0015	0.3483	-0.0498	0.0631	0.0471	0.0165
31	clothing and dress dealing (drapers, h	0.7113	-0.0499	0.1279	0.1423	0.1067	-0.0208	0.2308	0.0159	0.009	-0.1871	0.0202	0.169	0.0522	-0.0537	-0.0689	-0.0719	-0.0442	0.017
32	food sales (butchers, fishmongers, ch	0.3305	-0.038	0.4053	0.1556	0.1783	0.1916	0.1098	0.4072	-0.0594	0.1101	0.2127	0.096	0.1456	-0.1159	-0.0805	0.0668	-0.0777	-0.1317
33	lodging & drink sales (wine & spirits,	0.3157	0.0276	0.0475	0.7457	0.0967	-0.0012	0.0093	-0.0675	-0.0058	0.057	0.0945	0.143	0.0214	0.0096	-0.0836	0.0473	0.0221	-0.0169
34	stationery dealing (stationers, publish	0.1324	0.4971	0.2107	0.3851	-0.066	-0.0854	-0.2749	0.0639	-0.0167	0.1525	0.1453	-0.0478	-0.162	0.0478	0.0255	-0.0106	-0.1218	0.0437
35	h/h & personal goods dealer (earthen	0.1045	0.0713	0.0099	0.0567	-0.0291	-0.0327	0.0238	-0.0246	-0.0044	0.0382	0.0248	0.8754	-0.0177	0.0035	0.0157	0.0009	-0.0304	-0.0048
36	ironmongers	-0.1052	0.045	0.0856	0.0358	0.0454	0.0581	-0.1223	0.0666	-0.1335	0.1397	0.0422	0.222	-0.2722	0.2704	0.5679	-0.1075	0.0497	-0.1224
37	other retail (general shopkeeper, huc	0.3074	0.1388	0.4964	0.2551	0.0735	0.0437	-0.0692	0.1826	0.1124	-0.1276	0.1012	0.0906	-0.0118	-0.1829	-0.1527	-0.0422	0.2342	-0.1064
38	chemists, druggists	-0.0178	0.0926	0.1008	-0.012	0.1193	0.0189	0.1147	0.0427	0.0916	-0.0251	0.7814	0.0484	-0.0199	0.0547	-0.0139	-0.1067	0.0351	0.0855
39	merchants, banks, insurers and broke	0.2186	0.7657	-0.0902	0.0196	-0.0426	-0.0401	0.1149	0.0293	-0.088	0.0914	0.0514	0.0965	-0.0049	0.0104	0.0612	0.064	-0.0478	0.0432
40	other commerce (accountants, sales	0.3743	0.6142	0.0685	0.0912	0.2988	-0.0239	-0.0052	0.0913	0.0396	-0.0445	0.0544	0.0536	0.1033	-0.1242	-0.022	-0.0069	0.0473	-0.0216
41	construction management (builders a	0.5138	0.2986	-0.0336	0.0463	0.0953	-0.1465	0.3553	-0.2302	-0.0386	-0.0219	0.1803	-0.1682	0.1744	0.0625	-0.1079	0.0805	0.0824	-0.0026
42	professions (barristers, solicitors, scie	0.4787	0.4978	-0.2055	-0.0386	-0.009	0.0484	0.2378	-0.1286	-0.1266	-0.0583	0.1418	0.0328	-0.0613	0.0107	-0.0069	0.0348	-0.075	-0.0772
43	professions (doctors, dentists, artists,	0.7342	0.3925	0.0446	0.3372	0.0087	-0.0639	0.0111	0.0187	0.0319	-0.0749	0.0689	0.0032	-0.0191	0.0079	-0.0109	0.0561	0.1254	-0.0204
44	personal services (washing & bathing	0.8525	0.1521	-0.0087	0.0986	0.0777	-0.0698	-0.0196	-0.0443	0.0826	-0.0574	0.0352	0.0343	-0.01	0.0063	-0.0348	0.0059	0.1017	0.0008
45	Public admin, clergy	-0.0325	0.021	0.0764	0.0085	0.0481	-0.0821	-0.0444	-0.0173	0.0378	0.0456	-0.1	0.0054	-0.0813	-0.0514	0.0028	0.8182	-0.0146	0.0882
46	Military	0.0349	-0.0456	-0.0263	0.0024	0.0853	-0.0303	-0.0235	-0.0078	-0.0053	-0.0591	0.0377	0.0121	0.0018	0.8722	0.0583	-0.0392	-0.0376	-0.0288
47	Clerks, weighers, telegraph, non-theo	0.141	0.0608	0.0122	-0.0425	0.7651	0.0719	-0.0426	0.0289	0.0554	-0.0161	0.0646	-0.038	-0.0529	0.1206	-0.0864	-0.0584	0.0786	-0.025
48	Domestic and service staff, cooks	0.2542	-0.0641	-0.0389	0.0506	-0.015	-0.1159	-0.0208	-0.0472	0.0086	-0.0565	0.0801	-0.0582	0.0354	-0.0806	0.0567	-0.0476	0.7692	-0.0681
49	Labourers & transport staff (includin	0.1066	-0.0227	0.0527	0.0563	0.0126	0.0297	-0.0022	0.0019	-0.0598	0.0018	0.0894	-0.0042	0.0016	-0.0403	-0.0227	0.092	-0.0268	0.7869
50	Persons of property and unoccupied	0.0241	-0.1318	-0.0156	0.0005	-0.0191	-0.1313	-0.1285	0.0288	-0.0682	-0.1528	0.3536	-0.0419	-0.0475	-0.1824	0.0954	-0.1275	-0.4662	-0.2305



**Figure 7.** Mapping of the classification of each town for own account only: ‘original’ factor analysis classification

The factors can be summarised:

**Factor 1 (Professionals etc.)** [\* same as Factor 1 for all occupied; # same as Factor 1 for employers only]:

\*Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

Blacksmiths

#Ship, road & rail vehicle mf

Wood mf (sawyers, coopers, cane workers)

#Furnishing mf (cabinet makers, french polishers, undertakers)

#Printing & paper mf (paper, cardboard, printers, bookbinders)

#Shoe, boot, clog mf

Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

\*#Timber, hay, corn and agric produce dealing

\*#Clothing and dress dealing (drapers, hosiers, haberdashers)

\*#Construction management (builders and contractors)

\*#Professions (doctors, dentists, artists, performers, education)

\*#Personal services (washing & bathing, hairdressing, chimney sweeps)

Some major resorts but mainly diversified county towns (N=28). Highest loaded are: Bath, Canterbury, Chelmsford, High Wycombe, Ipswich, Lowestoft, Oxford, Ryde, Torquay, Winchester, Worthing. Includes Southampton, which is included but at 0.9, but which is very diversified as well as having resort characteristics from its ocean liner trade.

**Factor 2 (Commerce, gas and chemicals)** [# same as Factor 2 for employers only]:

#Gas, coke and chemical mf

Waterproof goods mf (floor & oil cloth, rubber etc.)

Stationery dealing (stationers, publishers, newsagents)

#Merchants, banks, insurers and brokers

Other commerce (accountants, salesmen, travellers, officers of cos.)

Professions (barristers, solicitors, scientific pursuits)

29 major commercial centres mainly in the NW. Highest loaded are: Eccles, Erith, Kingston Upon Thames, Leeds, Liverpool & Birkenhead, London, Manchester & Salford, Penarth, Sale, Southend-On-Sea, Southport, Teddington, Twickenham, Watford. These are the major cities, but also some smaller centres with similar high commercial and merchant mix, mainly around London.



**Factor 3 (metal mf and agric produce).** [# same as Factor 3 for employers only]:

#Other metal mf (copper, tin, brass, whitesmiths, etc.)

Argic. produce mf (millers, refiners, bakers, confectioners)

Other retail (general shopkeeper, huckster, hawker)

22 centres of based on traditional county towns that were mainly agricultural centres. Highest loaded are: Barnstaple, Beverley, Bishop Auckland, Exeter, Grantham, King's Lynn Newark Taunton, Ulverston, Warwick, Wrexham

**Factor 4 (lodgings, general mf. and transport):**

General mf (manufacturers, mechanic, artisan, machinist)

Road & rail transport

Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)

17 mainly resort centres; highest loaded are: Berwick, Blackpool (very much higher than all others), Bournemouth & Poole, Dover, Durham, Eastbourne, Harrogate, Hastings, Malvern, Margate, Penzance, Ramsgate, Scarborough, Weymouth.

**Factor 5 (sea transport and clerks):**

Ocean, inland and dock transport

Clerks, weighers, telegraph, non-theological students and apprentices

13 centres which are all small ports or small centres for transport that are not covered by ports that are also major commercial centres such as under Factors 1 and 2. Highest loaded are: Aldershot, Deal, Falmouth, Gravesend, Hounslow, Lincoln, Neath, Romford

**Factor 6 (iron & steel, earthenware and coal dealing):**

Iron & steel mf, bolts and nails

Earthenware & glass mf

Coal dealing

22 centres with strong metals and earthenware focus. Highest loaded are: Belper, Coseley & Sedley, Darlston, Dudley, Rowley Regis, Stoke-On-Trent, Tipton, Wednesbury, West Bromwich, Willenhall. Other pottery and metals towns also load on this factor but are more diversified.

**Factor 7 (farming and other mining):**

ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.



Farming, fishing, market gardeners, horse breeding and keeping

Other mining & quarrying, brickmaking, gravel, salt works

22 centres, mostly with intermediate loadings, mainly relating to non-coal mining and china clay (Cornwall and Poole), and quarrying (notably Weston-super-Mare). Highest loaded are: Camborne, Carmarthen, Dalton-In-Furness, Ebbw Vale, Ckinton, Mosborough & Renishaw, Llanelli, Poole, Redruth, Saddleworth, Truro, Weston-super-Mare.

#### **Factor 8 (woollen and other textiles):**

Woollen mf (woollen goods, carpets, blanket, flannel)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

22 centres in the main Yorks., and other textile districts such as Kidderminster and Trowbridge. Almost all are highly loaded.

#### **Factor 9 (machinery, tools & leather):**

Machinery mf

Tool & weapons mf

Leather, fur, hair & bone mf

23 towns, including Birmingham and Sheffield with strong metals and machinery, but not most of the W. Midlands and mainly including smaller dispersed centres such as Banbury, Boston, Bridgwater, Brighouse, Chichester, Colchester, Doncaster, Guildford, Hereford, Kettering, Maidstone, Redditch.

#### **Factor 10 (cotton, silk, watch and instruments):**

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

Watch & instrument mf

30 towns in Lancs. and Cheshire, plus Leek in Staffs.

#### **Factor 11 (chemists and property):**

Chemists, druggists

Persons of property and unoccupied

21 towns that are mainly smaller commercial centres. Highest loaded are: Castleford, Egham, Eston, Gainsborough, Grimsby, Horwich, Newton Abbot, Rugby, Whitehaven, Winsford, Wombwell.

**Factor 12 (household goods dealers):**

H/h & personal goods dealer (earthenware, glass, jewellers)

Only one town: Whitby

**Factor 13 (clothing mf.):**

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

13 centres of which the highest loaded are: Loughborough, Luton, Mansfield, St. Albans, Sutton In Ashfield, Yeovil. These appear to be some centres of outworking.

**Factor 14 (military):**

Military

4 centres: Cowes, Crompton, Maidenhead, Mirfield; dominated by an extreme loading for the sailing centre of Cowes.

**Factor 15 (ironmongers):**

Ironmongers [also loads on Factors 12 and 14]

*Negative* on general mf (manufacturers, mechanic, artisan, machinist) (-0.48)

19 towns, highest loaded: Barry, Blaenavon, Bury St Edmunds, Cleckheaton, Dartford, Folkestone, Oldbury, Shrewsbury, Stroud, Worcester. Some medium sized ports.

Interpretation can stop at this point. For the remaining three factors 16-18 there are no towns with loadings on the main occupational variables above 0.5, and the overall high loading on mostly no-entrepreneur occupations suggest this is absorbing a residual, probably also with occupational coding errors. Coal mining, the only entrepreneur category, has no loading above 0.26 on any of the factors. It is 0.26 for Factor 18, and 0.2 for Factor 7 (which includes other mining).

**Factor 16:**

Public admin, clergy

**Factor 17:**

Domestic and service staff, cooks

**Factor 18:**

Coal mining (highest loading, but only 0.26)

Labourers & transport staff (including family on farms)

This analysis is close to that for all occupied which is thought more reliable for use for classification, and also close to that for all entrepreneurs (employers and own account). Hence further analysis was not undertaken to produce a final mapping.

**6. Classification of towns for all entrepreneurs (employers plus own account)****6.1 All entrepreneurs: Male and female**

For all entrepreneurs, the main variance is overwhelmingly explained by the first Factor (see Table 9), with Factors 2, then 3-5, adding some explanation, then the rest, with the largest break after Factor 9. Compared to all occupied there are more significant loadings where there are multiple high scores across several factors, and many towns have closely similar values.

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	12.31768	9.17233	0.2464	0.2464
Factor 2	3.14535	0.96598	0.0629	0.3093
Factor 3	2.17937	0.19053	0.0436	0.3528
Factor 4	1.98884	0.06276	0.0398	0.3926
Factor 5	1.92608	0.29812	0.0385	0.4311
Factor 6	1.62796	0.00295	0.0326	0.4637
Factor 7	1.62501	0.01155	0.0325	0.4962
Factor 8	1.61346	0.01491	0.0323	0.5285
Factor 9	1.59855	0.26169	0.0320	0.5604
Factor 10	1.33685	0.06634	0.0267	0.5872
Factor 11	1.27051	0.05157	0.0254	0.6126
Factor 12	1.21894	0.03973	0.0244	0.6370
Factor 13	1.17921	0.02997	0.0236	0.6606
Factor 14	1.14925	-	0.0230	0.6835

**Table 9.** Factor variance – All entrepreneurs

Number of obs = 307

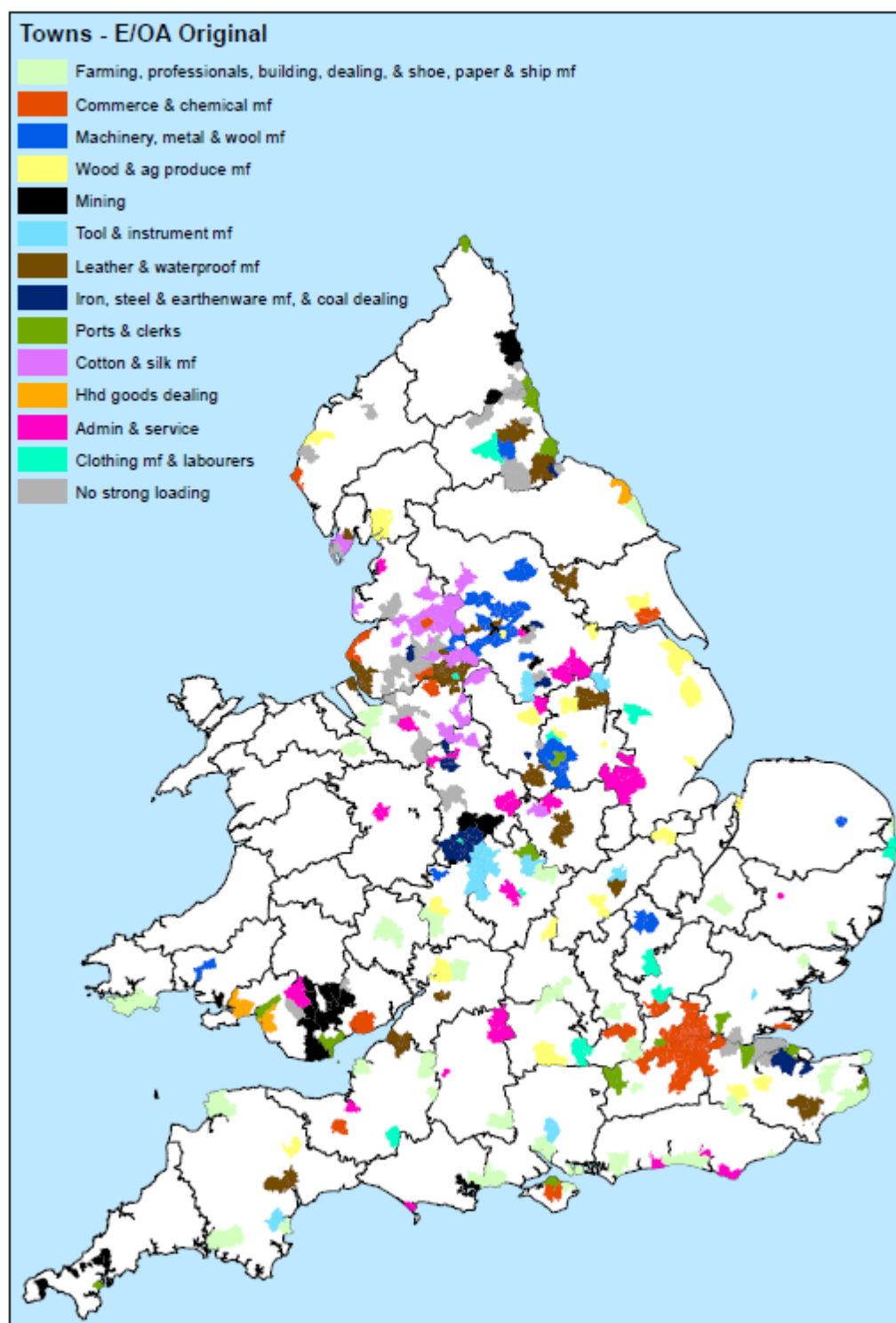
Method: principal-component factors Retained factors = 14

Rotation: orthogonal varimax (Kaiser off) Number of params = 609

LR test: independent vs. saturated:  $\chi^2(1225) = 8376.39$  Prob> $\chi^2 = 0.0000$

SOID	SOID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14
1	farming, fishing, market gardeners, horse breeding and keeping	0.5197	0.1376	0.091	0.1405	0.3775	-0.0994	-0.0369	-0.1483	0.0264	0.4869	0.0499	0.0141	0.0049	0.1029
2	coal mining	-0.3136	-0.1552	-0.101	-0.1353	0.5809	-0.0502	-0.0222	-0.0492	0.0189	-0.2451	-0.0896	-0.0118	-0.039	-0.0443
3	other mining & quarrying, brickmaking, gravel, salt works	-0.0052	0.0352	0.058	0.0187	0.7801	0.0145	0.0069	0.055	-0.0486	-0.0385	0.0755	-0.03	-0.1082	-0.0576
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.7229	0.2032	0.153	-0.0827	0.1203	0.072	0.0091	0.1128	0.1092	0.084	0.0457	-0.0338	0.0248	0.0095
5	machinery mf	0.0685	0.2836	0.438	0.1713	-0.0328	0.1658	0.231	0.3199	-0.115	-0.0563	0.4285	0.0764	0.0446	-0.0119
6	tool & weapons mf	0.0317	-0.0337	-0.0009	-0.0081	0.0477	0.8439	-0.0305	0.1657	0.0217	-0.0795	0.0092	0.0056	-0.001	-0.0141
7	iron & steel mf, bolts and nails	-0.2024	-0.0073	-0.0315	-0.0454	0.2926	0.1901	-0.0237	0.6719	0.0646	-0.2125	-0.0116	-0.1106	0.0084	-0.0633
8	blacksmiths	0.558	0.0495	0.0108	0.2899	0.5041	0.0081	-0.0071	0.049	0.0594	0.1294	-0.0933	0.0172	0.1015	-0.0012
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.0435	0.0296	0.4325	0.0353	0.1971	0.1128	0.3936	0.1697	-0.0224	0.0213	0.3107	-0.1291	0.0726	-0.059
10	ship, road & rail vehicle mf	0.7052	0.0933	-0.0865	0.2112	0.0547	0.0523	-0.0305	0.1505	0.1771	0.0602	0.085	-0.0447	0.0685	0.2791
11	earthenware & glass mf	0.1152	0.1405	-0.2433	0.08	-0.138	-0.1993	-0.0817	0.4885	-0.1459	-0.0689	0.1366	0.2977	-0.1963	-0.0901
12	gas, coke and chemical mf	0.2004	0.6695	0.1549	-0.0533	-0.1171	-0.0845	0.0796	0.0242	0.0642	-0.042	-0.1294	-0.1902	0.0308	-0.0125
13	leather, fur, hair & bone mf	0.3192	0.0877	0.3889	0.3425	-0.0722	0.2722	0.4018	0.0451	-0.0337	-0.0745	0.0647	-0.0758	-0.0112	0.0003
14	wood mf (sawyers, coopers, cane workers)	0.5759	0.0071	0.0615	0.4398	-0.17	0.0717	0.0364	0.2066	-0.0613	-0.0106	-0.0443	0.0668	0.3163	-0.032
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.6831	-0.0101	0.1486	-0.0301	-0.1502	0.0994	0.0551	0.0328	-0.1693	-0.0577	-0.1097	0.0336	0.0572	0.0991
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.5777	0.3882	0.1611	0.1008	-0.1015	0.2266	0.2899	0.0103	0.1519	-0.0141	0.036	-0.0611	0.0646	-0.0226
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.1009	0.2687	0.0183	0.0666	-0.0263	0.0759	0.7094	-0.0212	0.0313	0.1276	0.0671	0.0425	-0.108	-0.0481
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.0855	0.0485	0.7611	-0.0073	0.0784	-0.0641	0.0402	-0.0519	-0.0807	0.0181	0.0651	0.0158	-0.0782	0.0468
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.2799	0.176	0.0541	-0.0602	-0.1878	0.0366	0.088	-0.0333	-0.0825	0.705	-0.0485	-0.1227	0.0057	-0.0633
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.1101	0.1475	0.7112	0.0488	-0.0605	-0.0206	-0.0654	-0.0394	-0.0552	0.1488	-0.1491	0.0543	0.0577	0.0198
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	-0.043	0.0394	-0.0064	0.0671	-0.0882	-0.0101	-0.1023	-0.0272	0.0208	0.0247	0.1156	0.0527	0.8186	-0.0785
22	shoe, boot, clog mf	0.6962	-0.0963	0.0396	0.2385	0.0311	0.1091	0.1077	-0.0125	0.1527	-0.0109	0.0491	0.0302	0.0536	0.0737
23	agric produce mf (millers, refiners, bakers, confectioners)	0.4323	-0.0858	0.1016	0.685	0.1315	-0.0369	0.0905	-0.0349	-0.0411	0.01	-0.0015	0.0484	-0.0211	-0.0385
24	drink & tobacco mf (malsters, brewers, distillers, tobacco & pipes)	0.6854	0.0995	0.0478	0.2141	-0.2525	0.0685	0.1518	0.1496	0.0045	-0.2058	-0.0313	0.0343	-0.0596	-0.1403
25	watch & instrument mf	0.4265	0.0378	-0.0509	0.0432	-0.1222	0.6397	0.2081	-0.0583	0.0083	0.1832	-0.0192	0.0772	-0.0487	-0.033
26	general mf (manufacturers, mechanic, artisan, machinist)	0.2314	0.5928	0.0442	-0.0203	0.0274	0.2345	-0.398	0.0769	0.0908	0.1203	0.1317	0.0112	0.0387	-0.0849
27	ocean, inland and dock transport	0.3248	0.0744	-0.1036	-0.0726	-0.0109	0.0254	-0.1972	-0.0414	0.7047	0.0449	0.104	-0.0241	-0.0227	0.0376
28	road & rail transport	0.71	0.0712	0.0031	-0.3821	0.1345	-0.0913	0.0312	0.0315	0.0498	0.1654	0.0299	-0.0163	-0.1009	-0.1721
29	coal dealing	0.3506	-0.0109	0.0706	0.0347	-0.1384	0.1521	0.0421	0.6783	-0.0892	0.1428	-0.0462	-0.0664	0.0253	0.1306
30	timber, hay, corn and agric produce dealing	0.6583	0.1945	0.0499	0.3968	-0.0968	0.0401	0.0092	0.1071	-0.1282	-0.1152	-0.1037	0.047	0.0569	0.1525
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.8288	-0.012	0.0215	0.13	0.1478	0.0714	-0.0488	-0.0409	0.0226	-0.0969	0.1149	0.0058	0.0458	0.0391
32	food sales (butchers, fishmongers, cheesemongers, milk sellers, grocers)	0.8195	0.0129	0.1177	0.2291	-0.0282	0.014	-0.0317	0.0785	0.1562	0.0637	0.0637	-0.0184	0.0579	-0.0952
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.6661	-0.018	-0.0434	-0.2758	-0.0302	-0.0436	-0.1116	0.0446	0.1349	0.1404	0.2272	-0.0361	-0.0861	-0.2509
34	stationery dealing (stationers, publishers, newsagents)	0.7256	0.3091	0.1012	-0.2103	-0.2137	-0.0295	0.1749	-0.0513	0.0385	0.0049	-0.0039	-0.0124	-0.0491	0.0032
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.1955	-0.0062	-0.0178	-0.0356	0.0186	-0.025	0.0184	-0.0401	-0.0083	-0.0183	0.8009	-0.0054	0.0703	0.0602
36	ironmongers	0.6742	0.1423	0.0021	0.1801	-0.0107	0.1088	0.0217	0.0383	-0.0908	-0.0783	0.1443	-0.145	0.0133	0.1044
37	other retail (general shopkeeper, huckster, hawker)	0.3742	-0.0841	0.4865	0.0773	-0.0744	-0.0409	-0.0149	0.0361	0.1986	-0.1784	0.0212	-0.0136	-0.0546	-0.314
38	chemists, druggists	0.7894	-0.0272	0.0396	0.1771	-0.0344	0.0464	-0.0028	0.0887	-0.0161	0.0186	-0.0107	-0.0652	-0.0061	-0.0487
39	merchants, banks, insurers and brokers	0.257	0.8268	0.0478	-0.0186	0.0629	-0.0519	0.1029	-0.0066	0.0177	0.1181	0.0138	0.1441	0.0099	0.0586
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.6129	0.5819	0.0532	-0.0067	-0.0743	-0.023	0.2163	0.0251	0.1412	0.0404	0.0735	0.0452	0.0169	-0.0091
41	construction management (builders and contractors)	0.7567	0.3204	-0.1439	-0.0424	0.1695	0.0378	-0.0115	-0.1203	0.062	-0.1139	0.0014	0.1252	-0.0335	0.0846
42	professions (barristers, solicitors, scientific pursuits)	0.6167	0.5821	-0.0337	0.0919	0.0502	0.0132	0.0728	-0.0336	0.0431	0.0004	0.0307	0.0736	-0.0598	0.0788
43	professions (doctors, dentists, artists, performers, education)	0.8778	0.2897	0.0367	-0.1005	-0.0513	-0.0005	0.0455	-0.0253	0.0608	-0.0216	0.0372	0.0664	-0.0537	-0.052
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.836	0.17	-0.0799	0.0128	-0.0739	0.1003	-0.0376	-0.0794	0.0504	-0.09	0.0133	0.1569	0.0096	0.0526
45	Public admin, clergy	0.0627	0.1517	-0.0025	0.152	-0.0229	0.071	0.0123	-0.1213	0.0549	-0.1205	0.0101	0.6958	0.0781	-0.1145
46	Military	0.0189	0.0315	0.0101	-0.016	-0.0661	-0.0432	-0.0291	0.0172	0.1494	-0.0232	0.0552	-0.0436	-0.0805	0.7948
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.1631	0.1481	-0.0285	0.0227	-0.0131	0.031	0.1488	-0.0395	0.7518	-0.1034	-0.1133	0.0345	0.0082	0.1392
48	Domestic and service staff, cooks	0.3212	0.046	0.1504	-0.3487	-0.0556	0.0947	-0.0838	0.0051	-0.1846	-0.0564	-0.0388	0.492	0.0362	0.1598
49	Labourers & transport staff (including family on farms)	0.1826	-0.0607	-0.0802	-0.3379	0.0814	-0.0842	0.3474	0.0408	-0.1271	-0.0859	-0.2227	-0.0154	0.4826	0.0736
50	Persons of property and unoccupied	0.1154	0.1738	-0.0731	0.1037	-0.0229	0.2019	-0.267	-0.2701	-0.3282	-0.3237	0.0426	-0.4111	-0.0326	-0.0067

Table 10. Factor loadings – All entrepreneurs



**Figure 8.** Mapping of the classification of each town for all entrepreneurs: ‘original’ factor analysis classification

**Factor 1 (farming, professions, building etc.)** [\* same as Factor 1 for all occupied; # same as Factor 1 employers; + same as Factor 1 OA]:

Farming, fishing, market gardeners, horse breeding and keeping  
 \*#+=Construction operatives (masons, bricklayers, thatcher, plumbers etc.)  
 +Blacksmiths  
 #+Ship, road & rail vehicle mf  
 +Wood mf (sawyers, coopers, cane workers)  
 #++Printing & paper mf (paper, cardboard, printers, bookbinders)  
 #+Shoe, boot, clog mf  
 +Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)  
 \*#Road & rail transport  
 \*#+Timber, hay, corn and agric produce dealing  
 \*#+Clothing and dress dealing (drapers, hosiers, haberdashers)  
 \*#Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)  
 \*#Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)  
 \*#Stationery dealing (stationers, publishers, newsagents)  
 \*#Ironmongers  
 \*#Chemists, druggists  
 \*#Other commerce (accountants, salesmen, travellers, officers of cos.)  
 \*#+Construction management (builders and contractors)  
 \*#Professions (barristers, solicitors, scientific pursuits)  
 \*#+Professions (doctors, dentists, artists, performers, education)  
 \*#+Personal services (washing & bathing, hairdressing, chimney sweeps)

Although absorbing so many occupational categories, this is the main factor for only 37 towns. The highest loadings are for: Bournemouth & Poole\*, Brighton & Hove, Cambridge, Canterbury, Cheltenham, Chichester, Dover, Egham, Folkestone, Frome, Great Yarmouth, Guildford, Hastings\*, Hereford, High Wycombe, Malvern, Margate\*, Oxford, Ramsgate, Royal Tunbridge Wells, Rugby, Ryde, Salisbury, Scarborough\*, Torquay\*, Weston-Super-Mare\*, Windsor & Eton, Wrexham. The highest (marked \*) are all major resorts where there is less diversification, whereas a resorts like Brighton and Southampton are very diversified.

The lowest loaded on this factor (under 1.0) are either places which have large naval dockyards, which have been recognised as supressing local entrepreneurship (Pembroke,

Plymouth and Portsmouth), or are varied centres which do not load highly on any factor (Chester, Southampton and Windsor).

### **Factor 2 (commerce & chemicals):**

[# same as Factor 2 employers; + same as Factor 2 OA]

#+Gas, coke and chemical mf

#General mf (manufacturers, mechanic, artisan, machinist)

#+Merchants, banks, insurers and brokers

22 towns, mainly in London fringe, also on Manchester and Cardiff fringes (with Sale and Sutton by far the highest loadings), with the highest loadings: Altrincham, Bexley, Chertsey, Enfield, Kingston upon Thames, London, Penarth, Reigate, Sale, Southend-on-Sea, Southport, Sutton, Taunton, Teddington, Twickenham, Watford

### **Factor 3 (machinery, metals and wool):**

[# same as Factor 3 employers; + same as Factor 3 OA]

#Machinery mf

#+Other metal mf (copper, tin, brass, whitesmiths, etc.)

Woollen mf (woollen goods, carpets, blanket, flannel)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

+Other retail (general shopkeeper, huckster, hawker)

24 towns, mainly in Yorks. W. Riding, also Nottingham and Carmarthen. Highest for Ossett.

### **Factor 4 (wood and agricultural produce):**

[similar to Factor 8 for W/OA/E, with some additional elements]

Wood mf (sawyers, coopers, cane workers)

Agric produce mf (millers, refiners, bakers, confectioners)

22 towns, with highest loadings: Banbury, Beverley, Boston, Grimsby, Kendal, King's Lynn, Louth, Maidstone, Mansfield, Maryport, Mirfield, Newark, Newbury, Northampton, Peterborough, Tiverton, Tonbridge, Worksop

### **Factor 5 (Coal and other mining):**

Coal mining

Other mining & quarrying, brickmaking, gravel, salt works

24 towns, mainly in S. Wales and Cornwall. Highest loadings: Abercarn, Abersychan, Brighthouse, Brownhills, Camborne, Ebbw Vale, Hoyland Nether, Llanelli, Lye, Mountain Ash, Oakengates, Penzance, Poole, Redruth, Tredegar, Truro, West Houghton. Interestingly not Merthyr Tydfil and Pontypridd, which are highly loaded on this factor, but only at 0.88 and 0.71, respectively, as they are more diversified.

#### **Factor 6 (Tools and instrument mf):**

Tool & weapons mf

Watch & instrument mf

Nine towns, including Redditch, Coventry and Sheffield (which are the most highly loaded) and Birmingham which is lower loaded because of its diversification; all with concentrations of skilled tool, gun and metal trades; also some less obvious towns for this category, such as Winchester: Birmingham & Smethwick, Chelmsford, Coventry, Gainsborough, Kettering, Newton Abbot, Redditch, Sheffield, Winchester.

#### **Factor 7 (Leather and waterproof goods):**

Leather, fur, hair & bone mf

Waterproof goods mf (floor & oil cloth, rubber etc.)

Associated industries with lower loadings, but above 0.2:

Other metal mf (copper, tin, brass, whitesmiths, etc.)

Printing & paper mf (paper, cardboard, printers, bookbinders)

Watch & instrument mf

Other commerce (accountants, salesmen, travellers, officers of cos.)

Labourers & transport staff (including family on farms)

21 towns, highest loaded: Ashford, Ashton-Under-Lyne, Cleckheaton, Derby, East Retford, Heywood, Leicester, Liverpool & Birkenhead, Manchester & Salford, Sowerby Bridge, Ulverston, Wellingborough. Also includes lower loadings for: Bristol, Durham, Exeter, Hyde, Stockport, York. The inclusion of major centres such as Liverpool and Manchester on this factor appears to capture the opportunities for own account traders in leather etc. and waterproof goods mf, with ancillary commercial and industrial functions, interrelating with the other more low-loaded occupations which are often ancillary to these main centres.

#### **Factor 8 (Iron & steel, pottery, coal dealing):**

Iron & steel mf, bolts and nails

ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.



Earthenware & glass mf

Coal dealing

26 towns mainly in the W. Midlands, Staffs, and Teesside.

### **Factor 9 (Ports and clerks):**

Ocean, inland and dock transport

Clerks, weighers, telegraph, non-theological students and apprentices

17 towns, of which Deal is by far the highest loaded, followed by Cowes, and includes other medium to small ports. After reassignment of those with small sample numbers, there are 7 towns left in this factor: Deal, Gravesend, Falmouth, Tynemouth, Cowes, South Shields and Hartlepool, all of which are as small/medium ports.

### **Factor 10 (Cotton and silk):**

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

29 towns mainly in Lancs, Cheshire and Staffs; also includes Blackpool perhaps as a locations where employers live.

### **Factor 11 (H/h & personal goods):**

H/h & personal goods dealer (earthenware, glass, jewellers)

3 towns: Port Talbot, Swansea, Whitby. Of these only Whitby is very highly loaded; the others are at 0.5-0.6. Since this is essentially a 'Whitby-only' factor, Whitby is combined with Factor 8 in the final mapping (its second strongest loading), and Port Talbot and Swansea are assigned no strong loading.

### **Factor 12:**

Public admin, clergy

Domestic and service staff, cooks

23 towns, most of which have high loadings on other factors.

### **Factor 13:**

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

Labourers & transport staff (including family on farms)

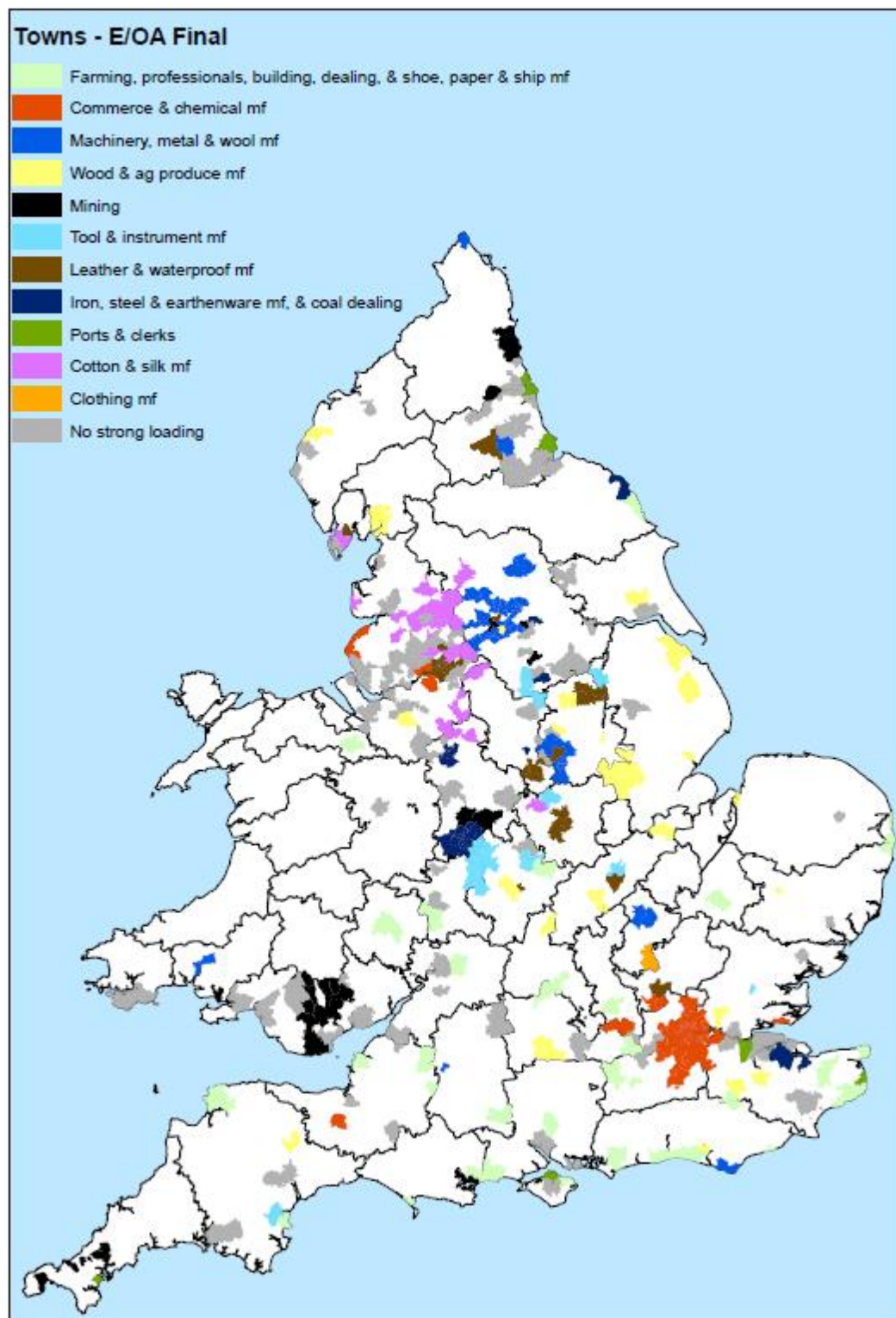
11 towns, most of which have high loadings on other factors.

**Factor 14:**

## Military

40 towns, none of which have a high loading on any factor, and none on Factor 14 above 0.49

Interpretation can stop at Factor 11, although factors 12 and 13 are mapped. For the remaining three factors 12-13 almost all have loadings that are also high on other factors, and for Factor 14 there are no towns with loadings on the main occupational variables above 0.5. The final classification, after reassigning all low loadings and small samples, and reassigning the whole of factors 11, 12 and 14, is shown in Figure 9.



**Figure 9.** Mapping of the classification of each town for all entrepreneurs: ‘final’ factor analysis classification.

## 6.2 All entrepreneurs employers and own account: female only

The factor variance for all female entrepreneurs (Table 11) has very low explained variance, although for all factors it become comparable with the other analyses. This indicates that female entrepreneurs are generally spread widely across occupations and locations, with few spatial concentrations. The factor loadings (Table 12) are also generally quite low. The wide spread is also indicated in the mapping, Figure 10. This results in a large number with no strong loading in the final classification (Figure 11)

Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.21329	0.28298	0.0671	0.0671
Factor2	1.93030	0.47929	0.0585	0.1256
Factor3	1.45101	0.07312	0.0440	0.1695
Factor4	1.37789	0.19198	0.0418	0.2113
Factor5	1.18591	0.03558	0.0359	0.2472
Factor6	1.15034	0.00138	0.0349	0.2821
Factor7	1.14896	0.01419	0.0348	0.3169
Factor8	1.13477	0.00478	0.0344	0.3513
Factor9	1.13000	0.03163	0.0342	0.3855
Factor10	1.09837	0.04658	0.0333	0.4188
Factor11	1.05179	0.00313	0.0319	0.4507
Factor12	1.04866	0.02498	0.0318	0.4825
Factor13	1.02368		0.0310	0.5135

**Table 11.** Factor variance – All female entrepreneurs.

Number of obs = 2,110

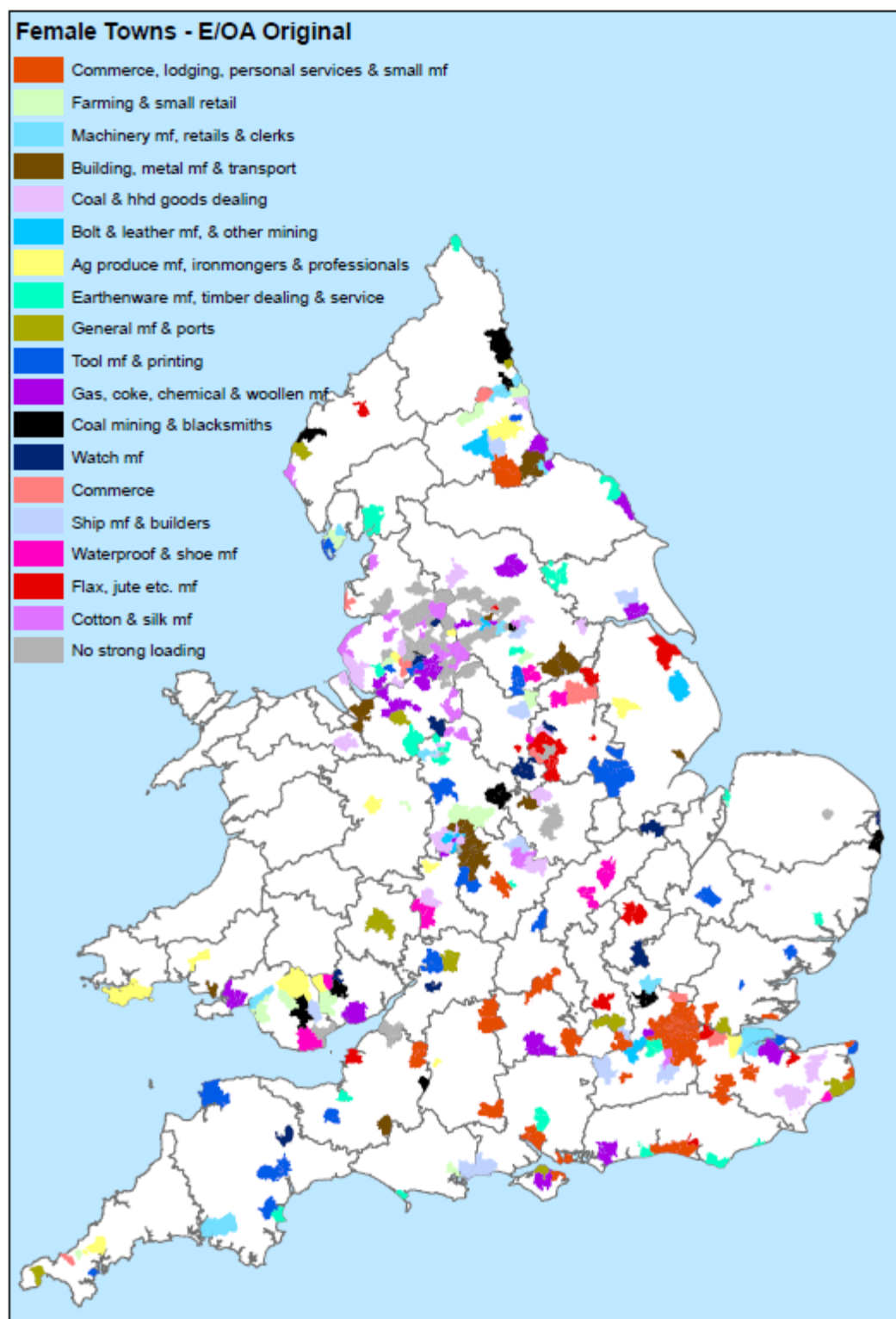
Method: principal-component factors      Retained factors = 13

Rotation: orthogonal varimax (Kaiser off)      Number of params = 351

LR test: independent vs. saturated:  $\chi^2(528) = 4075.80$  Prob> $\chi^2 = 0.0000$

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13	factor14	factor15	factor16	factor17	factor18
1	farming, fishing, market gardeners, horse breeding and	-0.0626	0.6526	-0.1142	-0.0264	-0.2216	0.0405	0.0412	-0.1673	-0.1075	-0.0353	-0.1156	-0.0546	-0.2215	-0.0048	0.0479	-0.0385	-0.0539	0.0993
2	coal mining	-0.0113	0.0839	-0.0319	-0.0044	0.0047	0.0611	-0.07	0.0071	0.1086	-0.0703	0.0048	0.7696	-0.0345	-0.0097	0.0099	0.0796	0.0277	-0.017
3	other mining & quarrying, brickmaking, gravel, salt w	0.0101	0.0132	0.0153	-0.0137	0.0844	0.7602	0.179	-0.0594	0.0258	-0.0236	-0.0374	0.0786	0.0572	0.0344	0.0444	0.0535	-0.0747	0.094
4	construction operatives (masons, bricklayers, thatche	0.0569	0.1253	0.0531	0.7886	0.0787	0.033	-0.0325	0.0273	0.068	0.0264	-0.0976	-0.0185	-0.0356	-0.0288	0.1887	-0.0033	0.0203	0.0904
5	machinery mf	0.1232	-0.0573	0.5713	0.2162	0.0091	0.0195	0.032	0.2707	-0.0925	0.0265	-0.1423	-0.0297	-0.0051	-0.1705	-0.0065	0.0252	0.179	0.2446
6	tool & weapons mf	0.096	-0.0929	0.0546	0.096	0.0264	0.045	0.0176	0.0768	0.0025	0.7714	0.0568	-0.0021	0.0134	0.1388	-0.0262	-0.0344	-0.1663	0.0688
7	iron & steel mf, bolts and nails	-0.1541	-0.1122	0.0132	0.0741	0.1034	0.4668	-0.1334	0.1044	0.2207	0.0831	0.2157	0.1967	-0.1346	-0.074	0.0693	0.2488	0.0295	-0.139
8	blacksmiths	0.2267	0.0758	-0.0716	-0.0095	0.436	-0.1533	-0.1265	-0.0372	-0.1315	0.036	-0.2546	0.4656	0.0489	-0.0643	-0.0891	-0.0677	-0.2302	0.0955
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	-0.0764	-0.0303	-0.0135	0.8063	0.0065	0.017	0.0122	0.0601	-0.0197	0.0619	0.1231	-0.0022	0.0073	0.0097	-0.1334	0.0266	-0.0595	-0.1084
10	ship, road & rail vehicle mf	0.2901	0.0254	0.0382	0.0343	0.1761	0.2235	-0.1469	0.2191	-0.1459	-0.2124	-0.0682	-0.0064	-0.0073	-0.2539	0.4391	0.1745	-0.1022	-0.1291
11	earthenware & glass mf	0.0333	0.1248	0.0479	0.2506	0.1205	-0.015	-0.0514	0.6384	-0.0304	0.042	0.1182	-0.0679	0.1084	0.0365	0.0025	-0.0679	-0.0487	-0.0368
12	gas, coke and chemical mf	0.0231	0.0791	-0.0396	0.0004	0.0691	-0.06	-0.0304	0.0218	0.0349	0.0017	0.7996	-0.0318	0.0721	-0.0342	-0.0051	0.0694	-0.0365	0.0842
13	leather, fur, hair & bone mf	0.0604	0.2964	-0.098	0.1258	-0.1191	0.5636	-0.0573	-0.0136	-0.0354	0.0839	-0.1178	-0.195	0.1485	0.0679	-0.0989	-0.1614	0.1425	0.0192
14	wood mf (sawyers, coopers, cane workers)	0.4049	0.037	-0.0768	0.0923	0.3593	0.0674	-0.135	-0.0981	0.024	0.076	0.1549	-0.1334	0.1207	-0.1554	-0.0411	-0.2915	0.3101	-0.0738
15	furnishing mf (cabinet makers, french polishers, unde	0.5702	0.0671	-0.074	0.0653	0.0496	-0.0782	0.0863	0.1968	0.0595	0.2664	0.0211	-0.1186	-0.0191	-0.1522	0.0398	-0.1223	0.1278	-0.0603
16	printing & paper mf (paper, cardboard, printers, book	0.2313	0.1126	-0.0841	0.0185	0.0383	-0.0217	-0.0166	-0.1545	-0.088	0.6305	-0.1234	-0.0851	-0.0688	-0.1856	-0.0196	0.1791	0.1407	-0.1598
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.1807	-0.1497	-0.1153	0.1841	-0.1269	0.0659	0.0145	-0.3191	-0.1776	-0.1527	0.0223	-0.1528	0.1784	0.0777	-0.1437	0.3574	-0.2477	-0.0488
18	woollen mf (woollen goods, carpets, blanket, flannel)	0.0084	0.0344	-0.0442	0.0501	-0.2137	0.0715	0.2824	0.0634	-0.2403	0.3006	0.3317	0.1214	0.1479	-0.0884	0.1399	-0.2241	-0.0299	-0.3012
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleac	-0.3905	-0.2452	0.0081	-0.121	-0.0173	-0.1094	-0.0267	-0.0934	-0.0625	-0.0493	-0.0488	-0.0792	0.2032	-0.0992	0.0287	-0.0707	0.0606	0.3859
20	other textile mf (flax, hemp, rope, jute, lace, tape, thr	0.2249	-0.0377	0.057	-0.0319	-0.0806	-0.0155	0.0065	-0.0146	-0.0962	-0.072	-0.022	0.0006	0.0145	0.0056	-0.0038	0.0876	0.7905	-0.0431
21	clothing mf (tailors, milliners, hosiery, hats, gloves, u	-0.0295	-0.0264	0.1259	0.0034	0.078	-0.102	0.0296	0.0423	-0.0169	-0.0124	-0.1286	-0.0113	0.0889	-0.0639	-0.0394	-0.0163	0.0819	-0.6854
22	shoe, boot, clog mf	0.1637	0.0825	0.0539	0.0284	0.0979	0.0442	-0.0205	-0.0159	-0.0309	0.096	0.0935	0.1018	-0.0375	-0.129	-0.0704	0.6914	0.1521	0.0054
23	agric produce mf (millers, refiners, bakers, confection	0.1442	0.1368	-0.1684	0.0444	-0.0638	0.0066	0.3696	0.0011	-0.3022	0.1203	0.0463	0.3329	0.181	-0.2109	0.0394	-0.1178	-0.0459	-0.0437
24	drink & tobacco mf (malsters, brewers, distillers, to	0.4636	0.0566	0.0267	0.0812	0.247	0.1322	-0.175	0.0661	-0.1072	-0.0475	0.3838	0.136	-0.168	0.2052	0.0648	-0.1213	0.2367	0.1
25	watch & instrument mf	0.0559	0.1134	0.0242	-0.0879	0.1295	-0.0494	-0.101	0.2811	0.065	0.3694	0.085	-0.0345	0.4378	-0.145	0.0413	0.0726	0.1682	0.3351
26	general mf (manufacturers, mechanic, artisan, mach	0.095	0.0352	-0.0399	0.0778	-0.0349	0.0484	0.122	0.0183	0.7842	-0.0066	-0.0359	0.0359	-0.0142	-0.0048	-0.0974	0.0273	-0.0813	0.0324
27	ocean, inland and dock transport	0.2198	0.0805	-0.0431	-0.0321	0.0215	-0.0184	-0.1392	-0.1158	0.5819	-0.0709	0.1632	0.0667	0.1542	-0.1484	0.2814	-0.1615	-0.0409	-0.0798
28	road & rail transport	0.2205	0.049	0.1506	0.3954	0.0293	-0.1059	0.0885	-0.0588	0.1938	0.0406	-0.141	0.1892	0.1899	0.3648	0.1372	0.0523	0.1541	0.1957
29	coal dealing	-0.0557	-0.029	0.0193	0.0762	0.781	0.1055	0.1532	0.0137	-0.0006	0.0347	0.0816	0.0571	-0.0848	0.1016	0.0787	0.052	-0.0735	-0.0538
30	timber, hay, corn and agric produce dealing	0.1678	0.1504	-0.0796	-0.1141	0.2329	0.3182	-0.165	0.3677	-0.1718	0.0409	-0.1325	-0.0445	0.1859	0.1011	-0.2833	-0.1907	0.0744	-0.0235
31	clothing and dress dealing (drapers, hosiers, haberdas	0.3323	0.7267	0.0223	0.0126	0.0509	-0.0152	0.0424	0.0789	0.0545	0.0333	-0.0063	0.1827	-0.1064	0.0522	0.0234	0.0932	0.0106	-0.0865
32	food sales (butchers, fishmongers, cheesemongers, r	0.0033	0.7596	0.2472	0.1072	0.1134	0.0785	0.126	0.046	0.0858	-0.0263	0.2133	0.0293	0.0256	0.0145	0.0162	-0.0064	-0.0072	-0.0039
33	lodging & drink sales (wine & spirits, hotels, inns, co	0.4203	0.2173	0.0505	-0.0303	-0.1709	-0.1319	0.0028	0.1591	0.0668	-0.0946	0.0204	-0.0047	0.2419	0.2131	0.0282	0.2772	-0.136	-0.0032
34	stationary dealing (stationers, publishers, newsagents	0.5328	0.0665	0.3831	-0.1596	0.0424	-0.0549	0.017	-0.0454	0.2114	0.103	0.1639	-0.1117	-0.1577	0.2304	-0.0697	-0.1246	-0.1292	-0.0637
35	h/h & personal goods dealer (earthenware, glass, jew	0.2428	0.2366	-0.0974	0.043	0.4313	-0.2123	0.2697	0.009	0.0291	0.0287	0.3245	-0.1603	0.1958	-0.106	0.0516	0.2216	0.1015	0.0328
36	ironmongers	-0.0736	0.1183	0.3247	-0.0059	0.0338	0.1333	0.4501	-0.1274	-0.1223	0.0331	0.1154	0.3661	0.1395	0.1873	-0.0939	0.0354	0.1386	0.0121
37	other retail (general shopkeeper, huckster, hawker)	0.223	0.2952	0.5205	0.049	0.2544	0.1007	0.0151	0.1292	0.0019	-0.0197	0.0142	-0.098	0.1986	-0.1987	0.2751	0.1067	-0.1473	-0.0677
38	chemists, druggists	-0.034	0.2215	-0.0589	-0.0077	0.0623	-0.1103	-0.0668	0.0282	-0.0204	0.0401	-0.0681	-0.0059	-0.7518	-0.0399	0.0981	0.0376	0.0112	0.0826
39	merchants, banks, insurers and brokers	0.4287	-0.2038	0.1642	0.2305	-0.0196	0.1556	-0.0079	-0.1201	-0.1332	-0.1028	0.1224	0.1034	-0.0552	-0.1951	-0.1298	-0.2099	-0.1797	0.3678
40	other commerce (accountants, salesmen, travellers, e	0.0909	0.0487	-0.0504	-0.0096	0.0712	0.073	-0.0513	0.0444	-0.0876	0.0142	-0.027	-0.0392	0.002	0.7485	0.1588	-0.0806	-0.0185	-0.0134
41	construction management (builders and contractors)	0.0854	0.0459	-0.0142	0.0368	0.0355	-0.0175	-0.0229	-0.0549	0.0051	0.0105	0.019	-0.0103	-0.0762	0.1886	0.7973	-0.0786	0.026	0.0384
42	professions (barristers, solicitors, scientific pursuits)	0.0713	0.1028	-0.0166	-0.015	0.1188	0.0627	0.8329	0.0488	0.0823	-0.0108	-0.0501	-0.1024	-0.0037	-0.0346	-0.0342	-0.0051	-0.0171	-0.026
43	professions (doctors, dentists, artists, performers, edu	0.7933	0.1968	0.1733	-0.046	0.0103	0.0021	0.0101	-0.0195	0.0731	0.0613	0.0177	-0.0039	0.049	0.0416	0.0422	0.1925	0.1266	0.0257
44	personal services (washing & bathing, hairdressing, c	0.8286	-0.0379	-0.0367	0.0203	-0.0198	0.0103	0.0832	0.0922	0.0475	0.082	-0.0668	0.0652	0.0769	0.0255	0.1104	0.0401	0.0963	0.028
47	Clerks, weighers, telegraph, non-theological students	0.0458	0.0868	0.7964	-0.013	-0.0799	-0.0571	-0.0293	-0.098	-0.0229	-0.0107	-0.0216	0.0063	0.0155	0.0534	-0.0442	0.0057	0.0395	-0.109
48	Domestic and service staff, cooks	0.2001	-0.149	-0.0522	-0.0311	-0.1955	-0.0635	0.1882	0.6197	-0.0139	-0.0391	-0.0183	0.053	-0.1159	0.0362	-0.0556	0.0844	-0.0286	-0.0568

Table 12. Factor loadings – All female entrepreneurs.



**Figure 10.** Mapping of the classification of each town for all entrepreneurs: ‘original’ factor analysis classification; females only.

**Factor 1 (commerce, lodging, personal services and small mf.):**

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Wood mf (sawyers, coopers, cane workers)  
 Furnishing mf (cabinet makers, french polishers, undertakers)  
 Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)  
 Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)  
 Stationary dealing (stationers, publishers, newsagents)  
 Merchants, banks, insurers and brokers  
 Professions (doctors, dentists, artists, performers, education)  
 Personal services (washing & bathing, hairdressing, chimney sweeps)

Strong negative loading on:

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

Strongly based in London, some reports and some ports

### **Factor 2 (Farming and small retail):**

Farming, fishing, market gardeners, horse breeding and keeping  
 Clothing and dress dealing (drapers, hosiers, haberdashers)  
 Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)  
 Chemists, druggists

### **Factor 3 (machine mf. and retail):**

Machinery mf  
 Other retail (general shopkeeper, huckster, hawker)  
 Clerks, weighers, telegraph, non-theological students and apprentices

### **Factor 4 (building and metal mf):**

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)  
 Other metal mf (copper, tin, brass, whitesmiths, etc.)  
 Road & rail transport

### **Factor 5 (dealers):**

Coal dealing  
 H/h & personal goods dealer (earthenware, glass, jewellers)

### **Factor 6 (Metals, quarrying, leather):**

Other mining & quarrying, brickmaking, gravel, salt works

Iron & steel mf, bolts and nails

Leather, fur, hair & bone mf

**Factor 7 (Agricultural produce, ironmongery):**

Agric produce mf (millers, refiners, bakers, confectioners)

Ironmongers

Professions (barristers, solicitors, scientific pursuits)

The towns in factor 7 tend to have a few E/OA in most of the factors other than 1 & 2, so look close to the dominant factor patterns. They have all been reassigned to any strong second factors in final classification.

**Factor 8 (earthenware & timber):**

Earthenware) & glass mf

Timber, hay, corn and agric produce dealing

Domestic and service staff, cooks

All reassigned to other factors, except Hanley, Longton and Tunstall, the constituent towns of Stoke in the Potteries.

**Factor 9 (general mf. and ports):**

General mf (manufacturers, mechanic, artisan, machinist)

Ocean, inland and dock transport

All small numbers, so whole factor reassigned to strong second factors.

**Factor 10 (tool mf & printing):**

Tool & weapons mf

Printing & paper mf (paper, cardboard, printers, bookbinders)

**Factor 11 (gas, chemicals and wool):**

Gas, coke and chemical mf

Woollen mf (woollen goods, carpets, blanket, flannel)

**Factor 12 (coal mining & blacksmiths):**

Coal mining

Blacksmiths



All small numbers, so whole factor reassigned to strong second factors.

**Factor 13 (watch & instrument mf.):**

Watch & instrument mf

Strong negative loading on:

Chemists, druggists

All small numbers, so whole factor reassigned to strong second factors.

**Factor 14 (other commerce):**

Other commerce (accountants, salesmen, travellers, officers of cos.)

All small numbers, so whole factor reassigned to strong second factors.

**Factor 15 (ship mf. & building):**

Ship, road & rail vehicle mf

Construction management (builders and contractors)

All small numbers, so whole factor reassigned to strong second factors.

**Factor 16 (waterproof goods & shoes):**

Waterproof goods mf (floor & oil cloth, rubber etc.)

Shoe, boot, clog mf

**Factor 17 (Flax & other textiles):**

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

All small numbers, so whole factor reassigned to strong second factors, except Bedford, Nottingham and Carlisle.

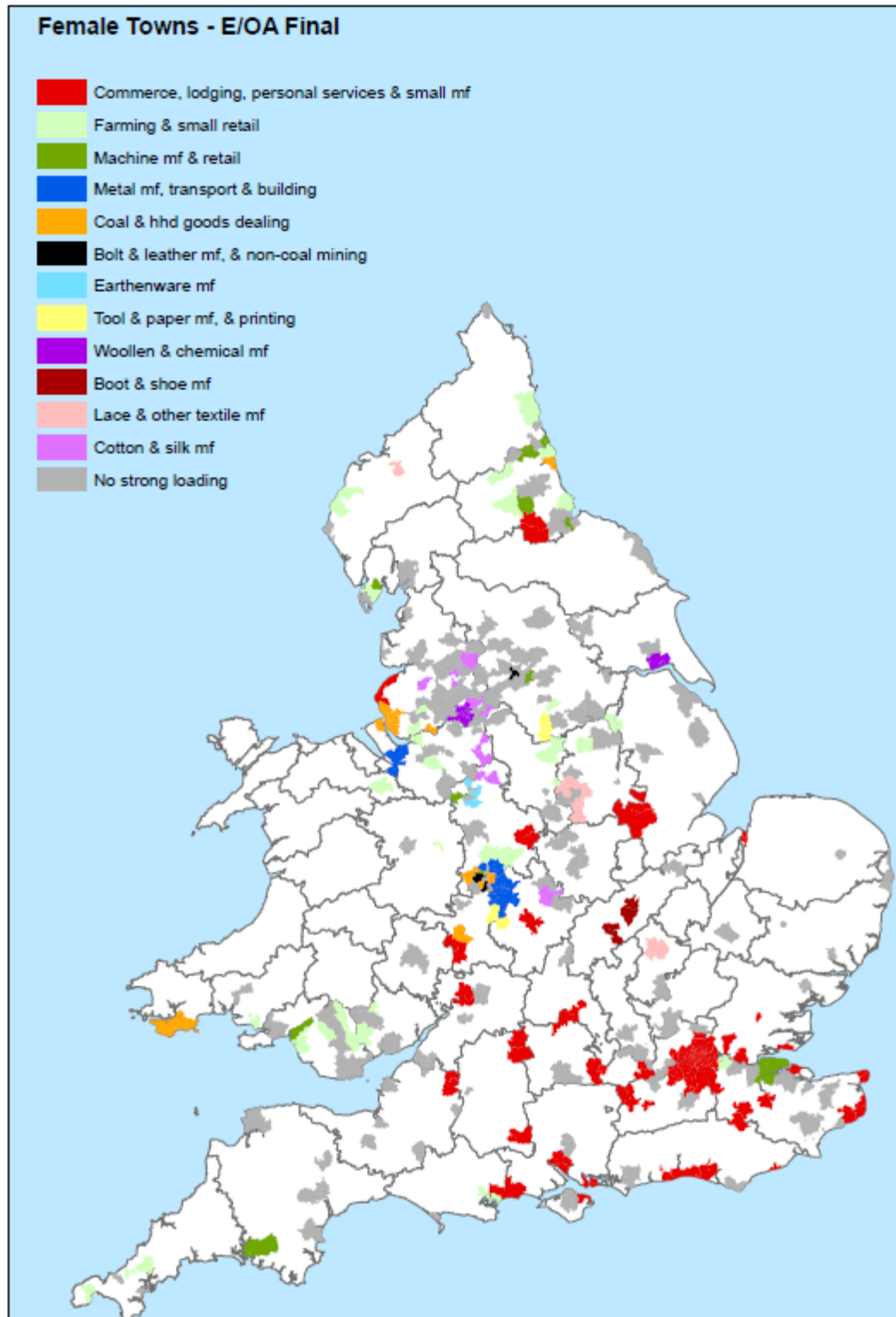
**Factor 18 (cotton & silk):**

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

Strong *negative* loading on:

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

The final classification has 13 factors plus no strong loading; after removal of factors 7, 12-15. After removing small sample sizes many towns have no strong loadings.



**Figure 11.** Mapping of the classification of each town for all entrepreneurs: ‘final’ factor analysis classification; females only

## 7. Conclusion

The classification developed here focuses on the 307 towns and cities of 10,000 population and greater in 1891 based on an aggregation of occupational categories into 50 groups. Because the number of locations is relatively small, and they have been pre-classified to be urban areas, as expected, the variation between places is generally more limited with most factor analyses showing a dominance of the first 2-3 factors, with the first factor usually dominating. Only the female analyses have very wide variances across many factors. Hence, except for females, the results from each data series (all occupied, employers only, own account only, and all entrepreneurs) are similar in concentrating the variance, with the first factor explaining 20% of the variance for all occupied, 24% for all entrepreneurs, 22% for employers, and 15% for own account; but only 11% for females all occupied and 7% for all female entrepreneurs. Beyond the first 4-5 Factors the analysis runs to 14 or 18 Factors, with the highest Factors in some cases picking up potentially important characteristics that are concentrated in only a few towns.

The analysis of own account is the most varied and least easily captured. It has not been taken to a final stage of classification. For further use, the classifications of all occupied, all entrepreneurs, and employer only entrepreneurs appear the most stable and useful, after following a 'directed' methodology to clean for small sample sizes, allowing for multiple loadings, and tensioning against existing understanding.

These results are a pilot for the application of similar methods to other census years and for the development of the classification for use for a range of analytical purposes. These developments are summarised in subsequent working papers.

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The database used derives from K. Schürer, E. Higgs, A.M. Reid, E.M Garrett, *Integrated Census Microdata, 1851-1911, version V. 2 (I-CeM.2)*, (2016) [data collection]. UK Data Service, SN: 7481, <http://dx.doi.org/10.5255/UKDA-SN-7481-1>; enhanced; E. Higgs, C. Jones, K. Schürer and A. Wilkinson, *Integrated Census Microdata (I-CeM) Guide*, 2nd ed. (Colchester: Department of History, University of Essex, 2015).

ESRC project ES/M010953: WP 7: Smith et al.: *Classification of towns in 1891 using factor analysis*, Cambridge University.

The data used for the 1881 pilot and in this paper derives from Schürer, Kevin and Woollard, Matthew (University of Essex) (2000) *1881 Census for England and Wales, the Channel Islands and the Isle of Man (Enhanced Version)* [computer file] UKDA, SN-4177, supported by ESRC, derived from the manuscript census enumerators' books, transcribed by Genealogical Society of Utah and Federation of Family History Societies.

The GIS boundary files for RSDs were constructed by Joe Day for the ESRC fertility project directed by Alice Reid:

<http://www.geog.cam.ac.uk/research/projects/victorianfertilitydecline/publications.html>

These used as a starting point the GIS parish files of Satchell, A.E.M., Kitson, P.M.K., Newton, G.H., Shaw-Taylor, L., Wrigley E.A. (2006) *1851 England and Wales census parishes, townships and places*, 2006, ESRC RES-000-23-1579, supported by Leverhulme Trust and the British Academy; Satchell, A.E.M. (2015) *England and Wales census parishes, townships and places*; which is an enhanced and corrected version of Burton, N, Westwood J., and Carter P. (2014) *GIS of the ancient parishes of England and Wales, 1500-1850*, UKDA, SN 4828; which is a GIS version of Kain, R.J.P., and Oliver, R.R. (2001) *Historic parishes of England and Wales: An electronic map of boundaries before 1850 with a gazetteer and metadata*, UKDA, SN 4348.

## References

- Goldberg, L. R. and Velicer, W. F. (2006) Principles of Exploratory Factor Analysis, in Strack, Stephen (ed). *Differentiating normal and abnormal personality*, 2nd ed. New York: Springer Publishing Co.
- Kaiser, H. F. (1958) The varimax criterion for analytic rotation in factor analysis, *Psychometrika*, 23, 187-200.
- Osborne, J. W. and Costello, A. B. (2005) Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis, *Practical Assessment, Research & Evaluation*, 10(7), 1-9.
- Rummel, R. J. (1967) Understanding factor analysis, *Journal of Conflict Resolution*, XI (4), 444-480.
- Rummel, R. J. (1970) *Applied factor analysis*, Evanston: Northwestern University Press.
- Schürer, K., Higgs, E. Reid, A.M., and Garrett, E.M., *Integrated Census Microdata, 1851-1911, version V. 2 (I-CeM.2)*, (2016) [data collection]. UK Data Service, SN: 7481, <http://dx.doi.org/10.5255/UKDA-SN-7481-1>; enhanced; E. Higgs, C. Jones, K. Schürer and A. Wilkinson, *Integrated Census Microdata (I-CeM) Guide, 2nd edn.* (Colchester: Department of History, University of Essex, 2015).
- Smith, Harry, Bennett, Robert J., and Radicic, Dragana (2017) *Urban-Rural Classification using Census data, 1851-1911*, Working Paper 6: ESRC project ES/M010953: 'Drivers of Entrepreneurship and Small Businesses', University of Cambridge, Department of Geography and Cambridge Group for the History of Population and Social Structure.
- Yong, A.G. and Pearce, S. (2013). A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis, *Tutorials in Quantitative Methods for Psychology*, 9(2), 79-94.

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